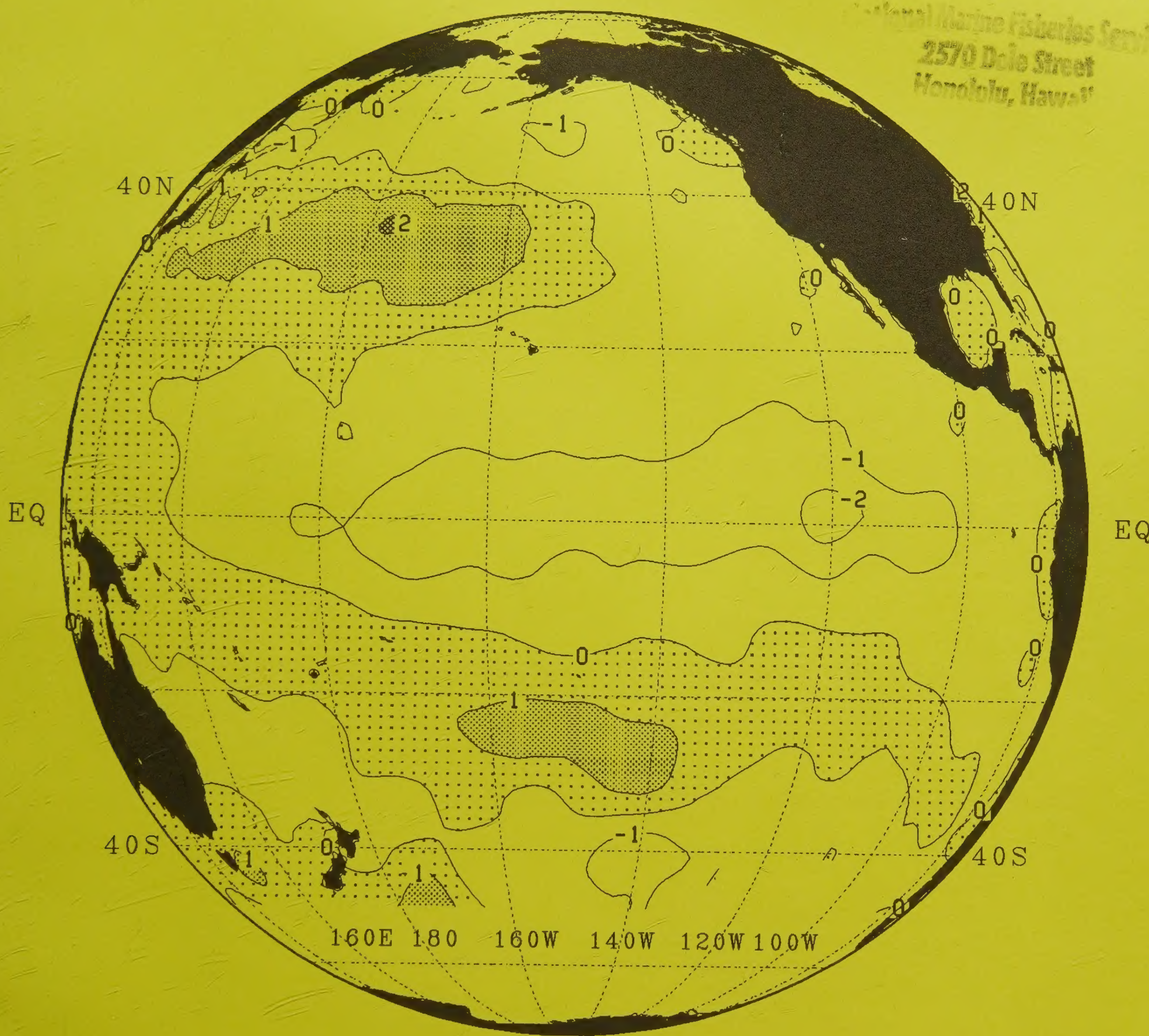
気　象　庁　海　洋　月　報

Monthly Ocean Report

December 1999 (No. 84)



Climate and Marine Department
Japan Meteorological Agency

気象庁　気候・海洋気象部

平成１１年１２月

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本月報に関する問い合わせは、

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Monthly Ocean Report is prepared by the Oceanographical Division, Climate and Marine Department, Japan Meteorological Agency.

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表紙は、1999年12月の太平洋の月平均海面水温偏差図です。
陰影部は、平年より高温の海域を示しています。

The figure on the front cover shows the monthly mean SST anomalies for December 1999 in the Pacific Ocean.
Areas of positive anomalies are shaded.

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海況の特徴（１９９９年１２月）

日本近海の海況

海面水温は、オホーツク海南部で平年より1℃以上低く、能登半島沖から津軽海峡にかけてと常磐から房総半島沖にかけて1℃以上高かった（第４図）。

黒潮は、九州から紀伊半島にかけて接岸した後、東海沖で大きく南に蛇行し、八丈島の南を通って、32゜N、141゜E付近から北北西に流れていた。蛇行の南端は、上旬は31.5゜N、中・下旬は32゜Nに達していた。その後、黒潮は三宅島の東で向きを変え、房総半島沖を北東に流れていた（第9図）。

親潮系の冷水の沖合の分枝は、41.5゜N、148゜Eまで達していた（第5図）。

太平洋の海況

太平洋赤道域の海面水温は、175゜Eから105゜Wにかけて平年より1℃以上低く、エルニーニョ監視海域（4゜N～4゜S、150゜W～90゜W）の月平均海面水温偏差は－1.5℃であった。一方、150゜E以西では＋0.5℃を超える正偏差となっていた。

北太平洋では、25゜Nから40゜Nの140゜Eから160゜Wにかけて、南太平洋では、25゜S付近の165゜Wから135゜Wにかけて、それぞれ+1℃を超える正偏差が見られた（第16図）。

Highlights December 1999

Seas adjacent to Japan

Negative SST anomalies exceeding -1°C prevailed in the southern part of the Sea of Okhotsk, and positive anomalies exceeding +1°C prevailed from the seas off the Noto Peninsula to the Tsugaru Strait, and from the seas off Joban to those off the Boso Peninsula (Fig. 4).

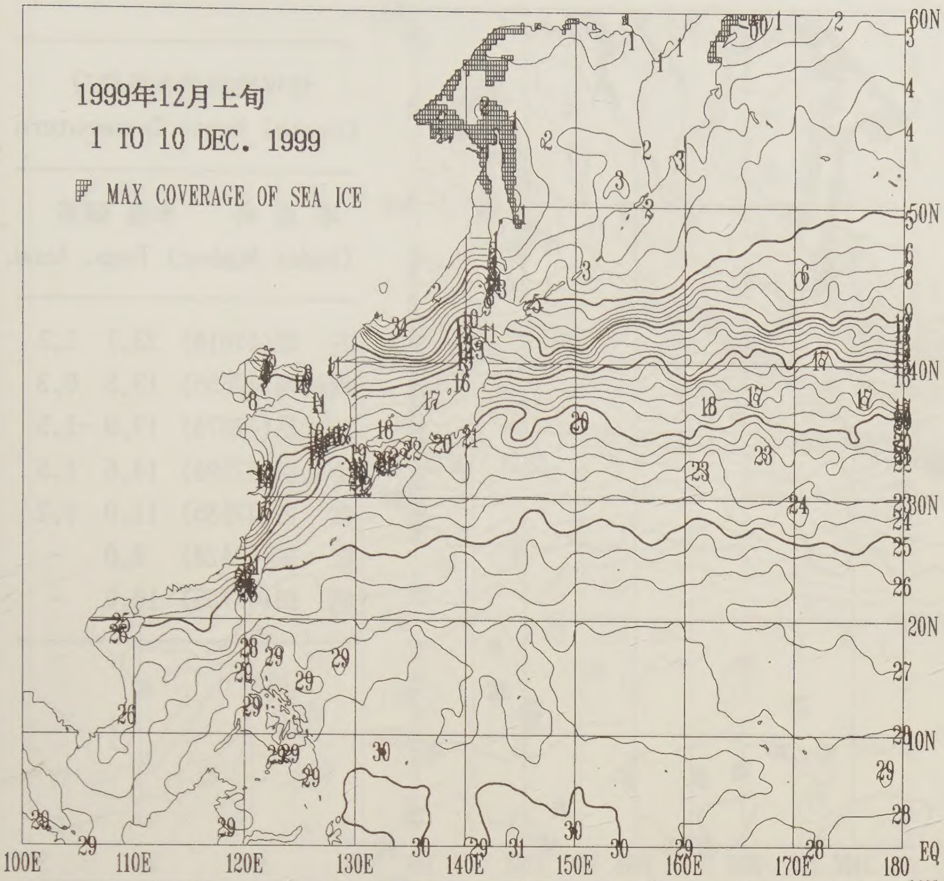
The Kuroshio flowed along the coasts from Kyushu to the Kii Peninsula, then largely meandered off Tokai. After passing south of Hachijo island, it flowed NNE-ward from 32°N, 141°E. The southernmost position of the meander reached 31°N in the first 10-day of the month and was 32°N in the rest of the month. The Kuroshio turned NE-ward east of Miyake island and flowed off the Boso Peninsula (Fig. 9).

Off-coastal branch of the Oyashio cold water extended southward to 41.5°N, 148°E (Fig. 5).

Pacific Ocean

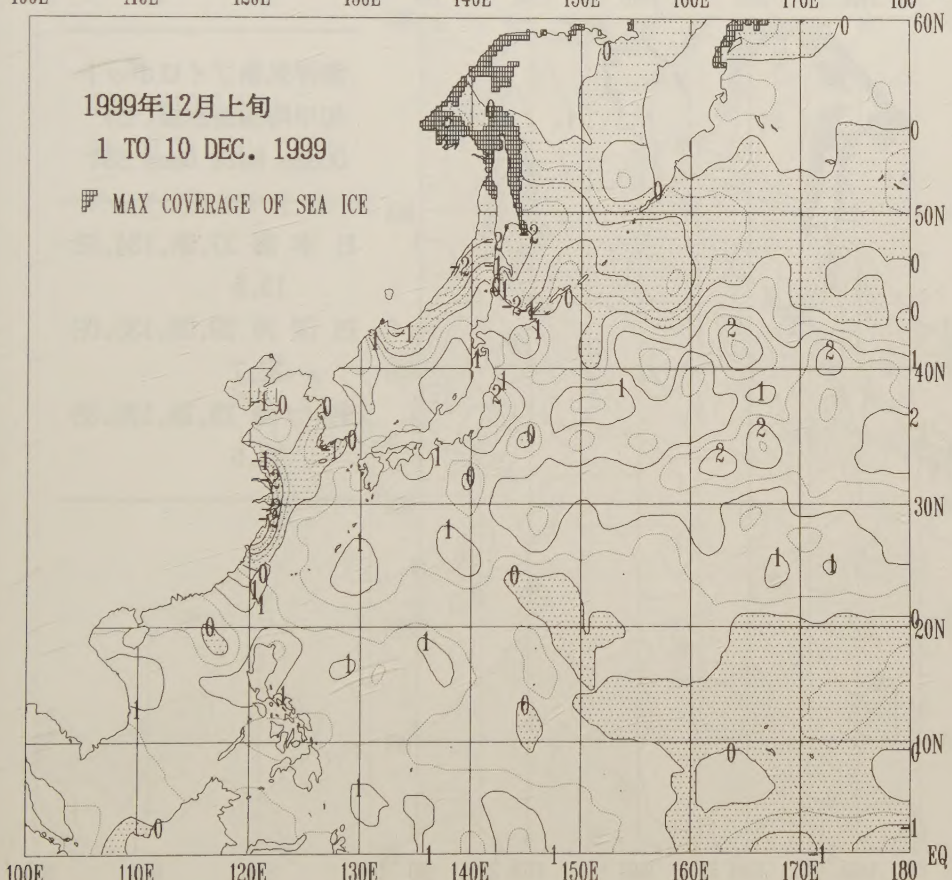
In the equatorial Pacific, negative SST anomalies exceeding -1°C prevailed from 175°E to 105°W. The monthly mean SST anomaly for the El Niño monitoring region (4°N-4°S, 150°W-90°W) was -1.5°C. SSTs were more than 0.5°C above normal west of 150°E.

Positive SST anomalies exceeding +1°C prevailed from 140°E to 160°W between 25°N to 40°N in the North Pacific and from 165°W to 135°W along 25°S in the South Pacific, respectively (Fig. 16).



旬平均沿岸水温(℃)
Coastal Water Temperature

地点名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	23.4	1.0
御前崎(47655)	15.8	1.5
八丈島(47678)	20.0	0.0
小名浜(47598)	16.3	2.5
宮　古(47585)	13.8	1.1
江　差(47428)	8.3	-
浜　田(47755)	16.4	-

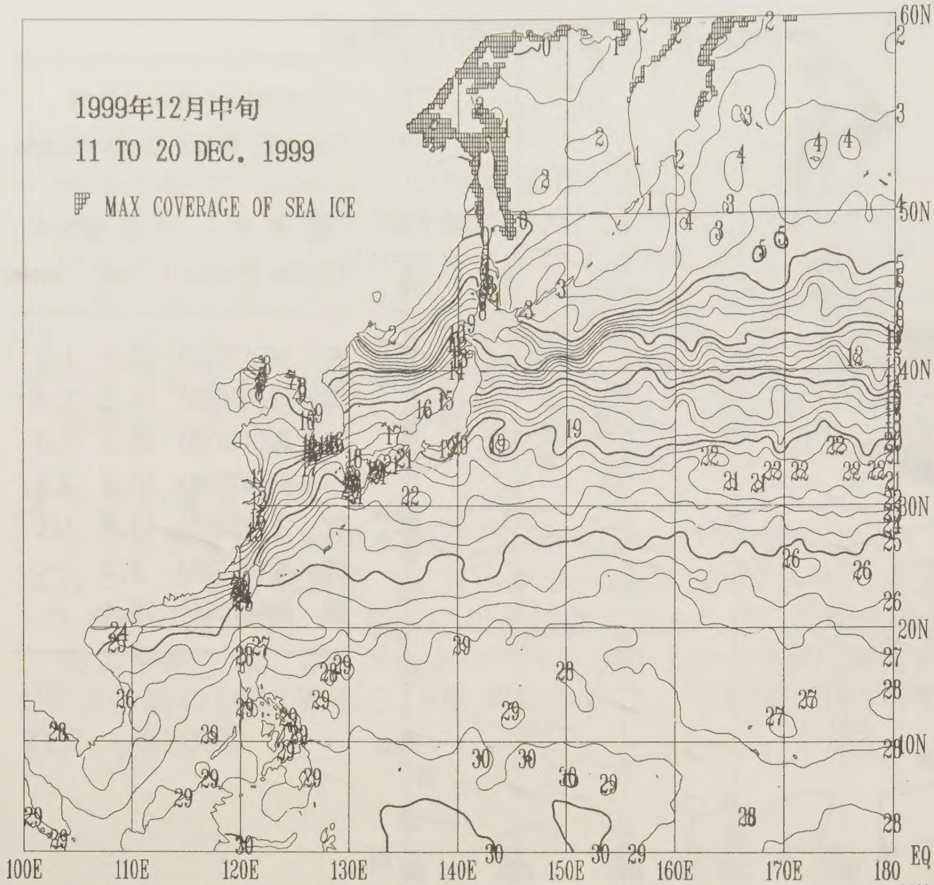


海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日本海	37.9N,134.5E	16.7
四国沖	29.0N,135.0E	23.2
東シナ海	28.2N,126.3E	23.5

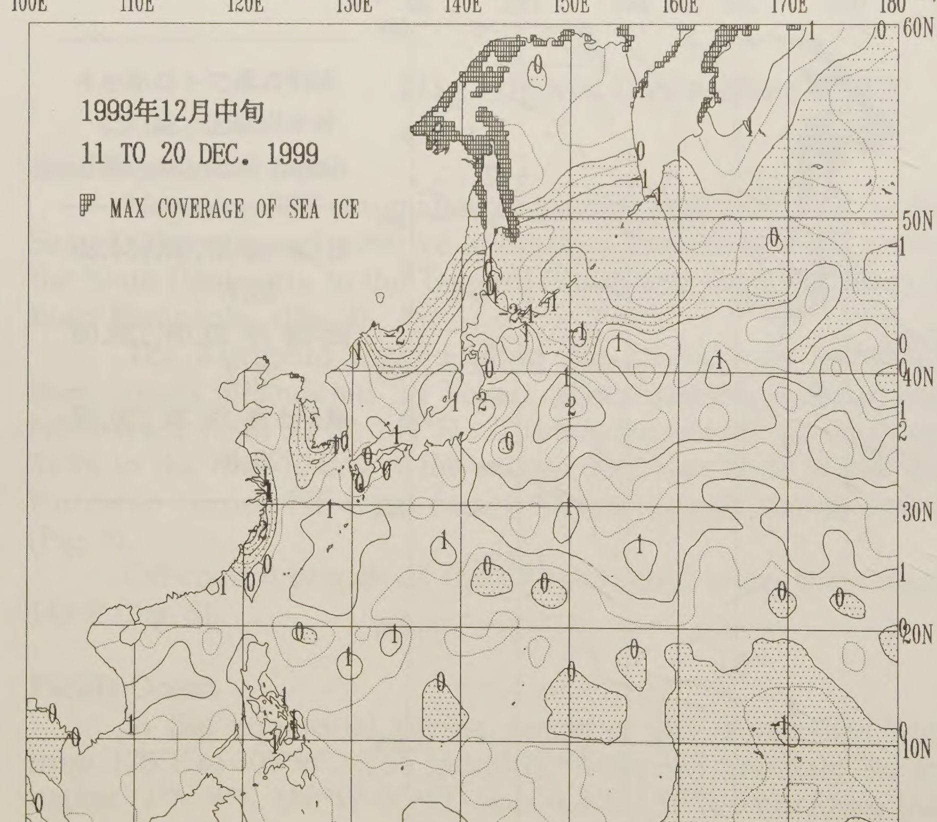
第1図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1999年12月上旬)

Fig.1 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 1st ten-day period in DEC 1999. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



旬平均沿岸水温(℃)
Coastal Water Temperature

地 点 名 (Index Number)	水温 Temp.	偏差 Anom.
石 垣(47918)	23.1	1.3
御前崎(47655)	13.8	0.3
八丈島(47678)	17.9	-1.5
小名浜(47598)	14.6	1.5
宮 古(47585)	11.9	0.2
江 差(47428)	8.0	-
浜 田(47755)	16.0	-

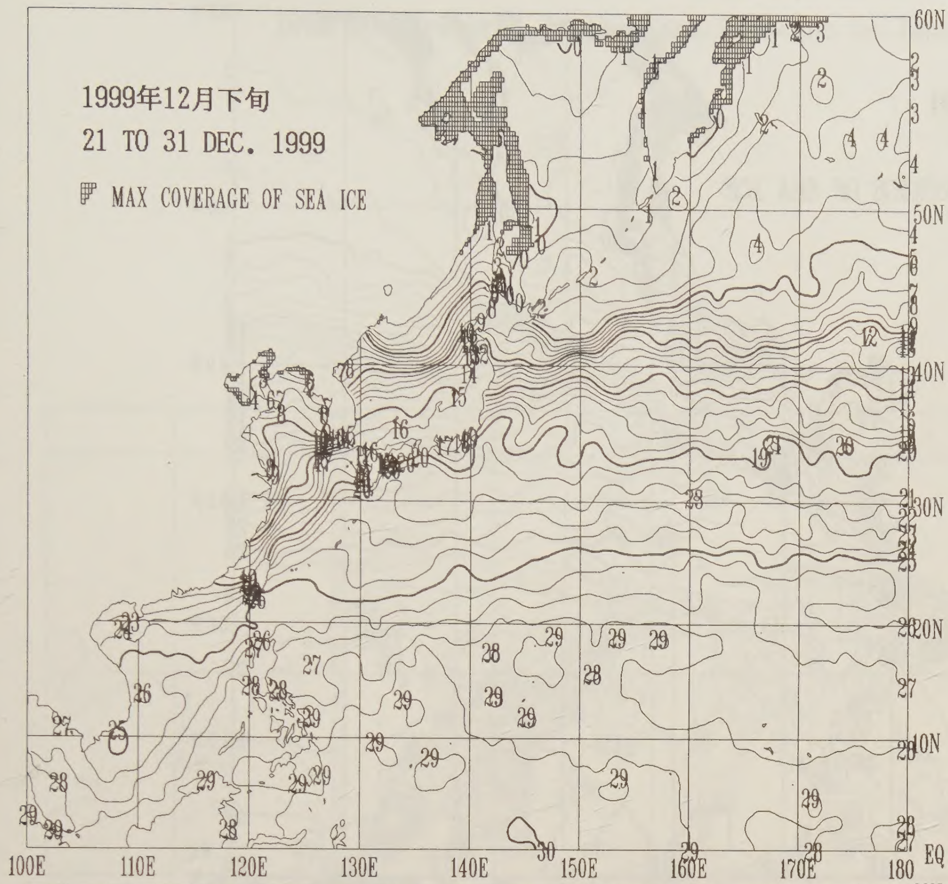


海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日本海	37.9N,134.5E	15.5
四国沖	29.0N,135.0E	22.7
東シナ海	28.2N,126.3E	22.5

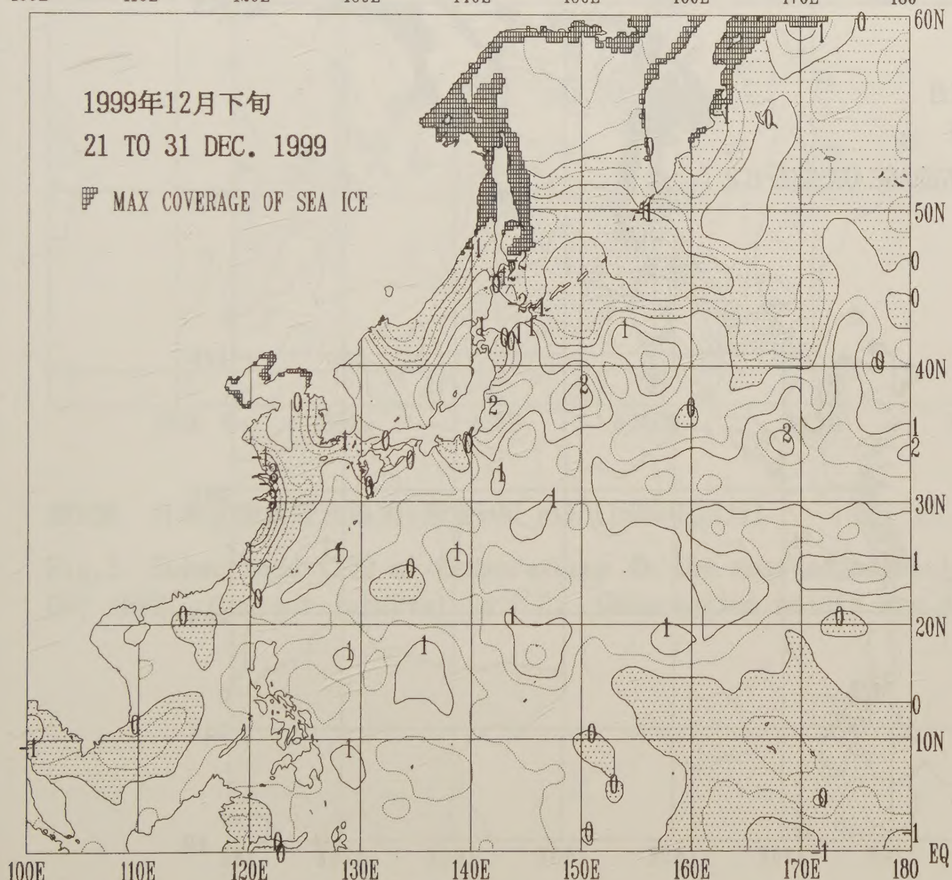
第2図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1999年12月中旬)

Fig.2 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 2nd ten-day period in DEC 1999. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



旬平均沿岸水温(℃)
Coastal Water Temperature

地点名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	21.7	0.2
御前崎(47655)	12.9	0.5
八丈島(47678)	16.5	-2.1
小名浜(47598)	13.2	1.1
宮　古(47585)	11.4	0.7
江　差(47428)	10.0	-
浜　田(47755)	13.6	-

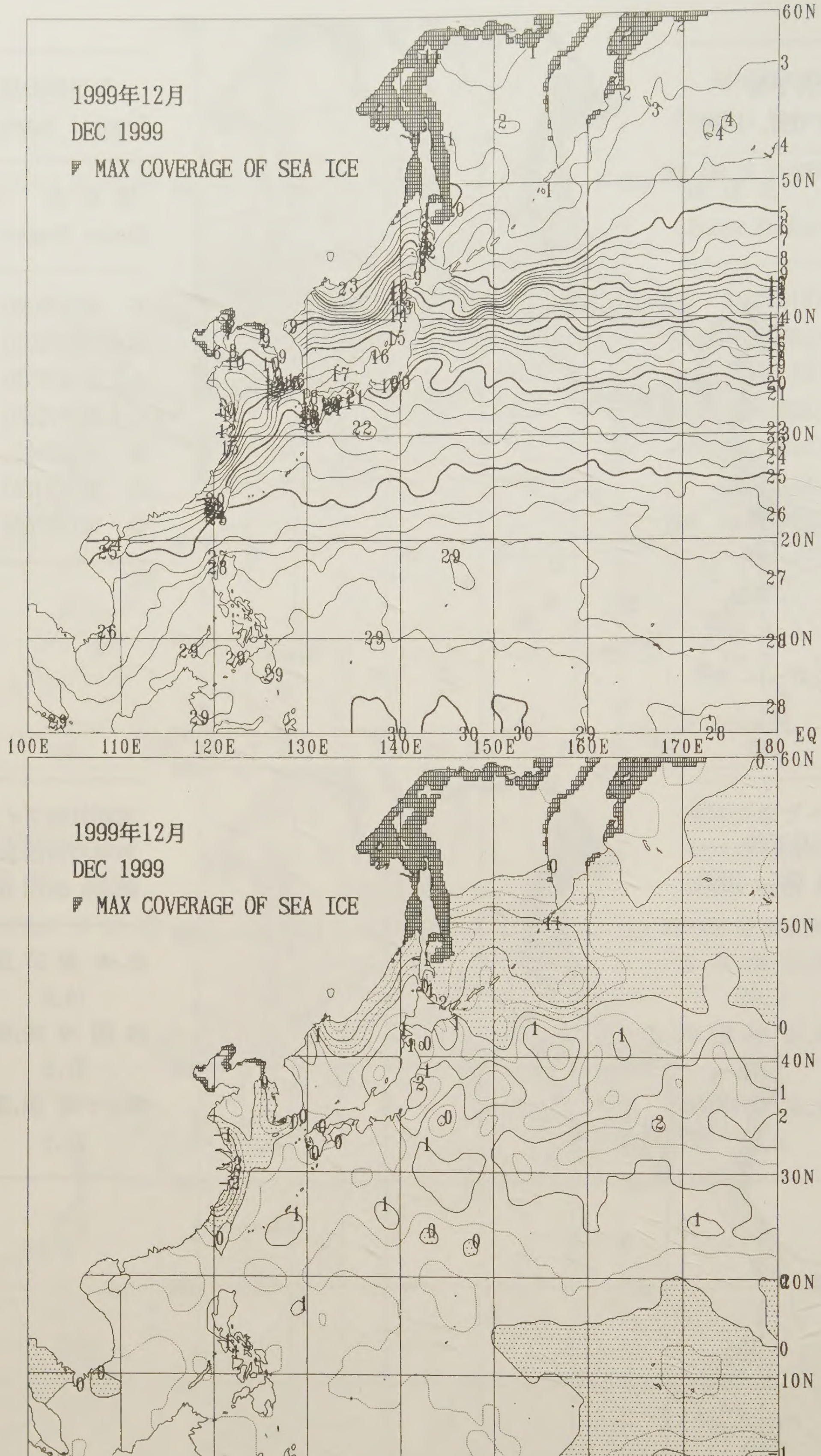


海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日本海	37.9N,134.5E	14.5
四国沖	29.0N,135.0E	21.3
東シナ海	28.2N,126.3E	21.5

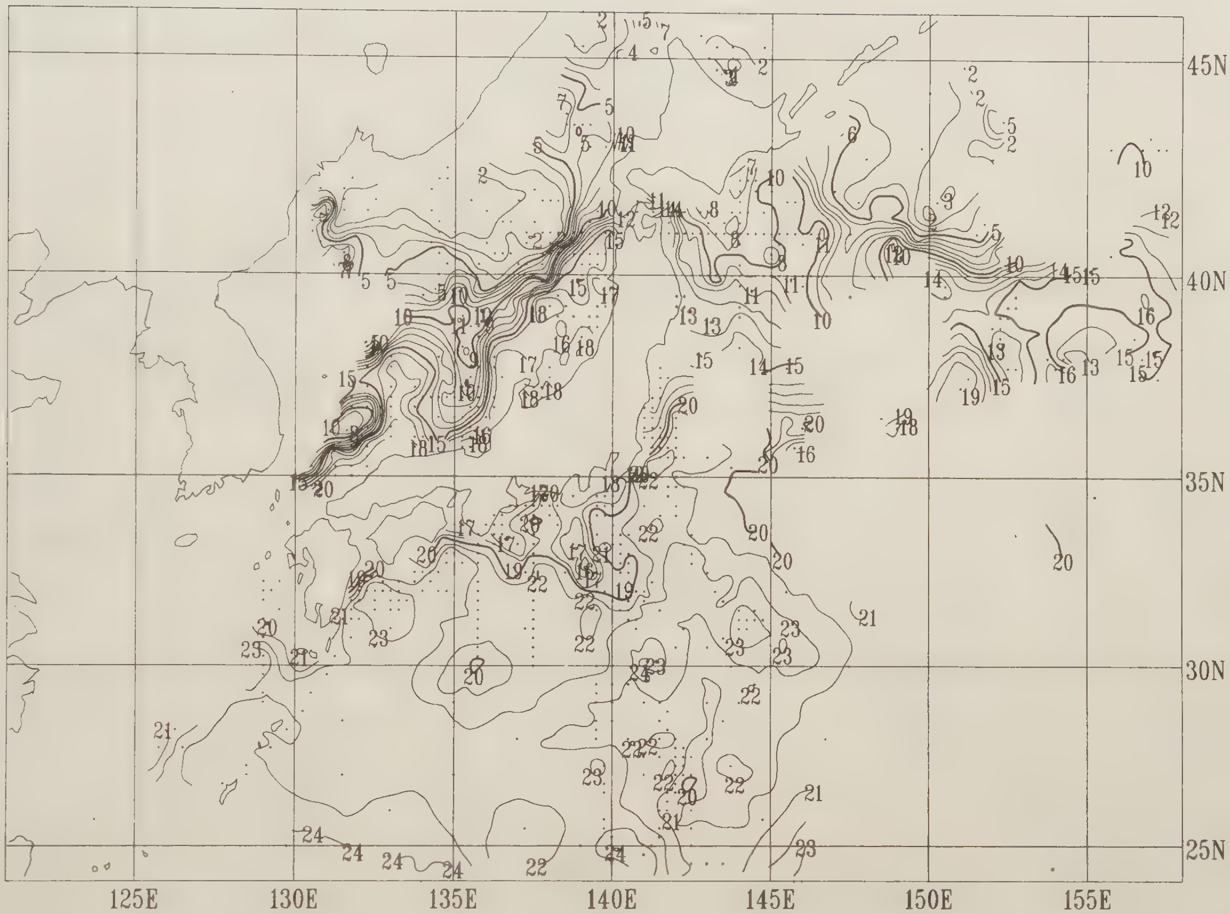
第3図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1999年12月下旬)

Fig.3 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 3rd ten-day period in DEC 1999. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



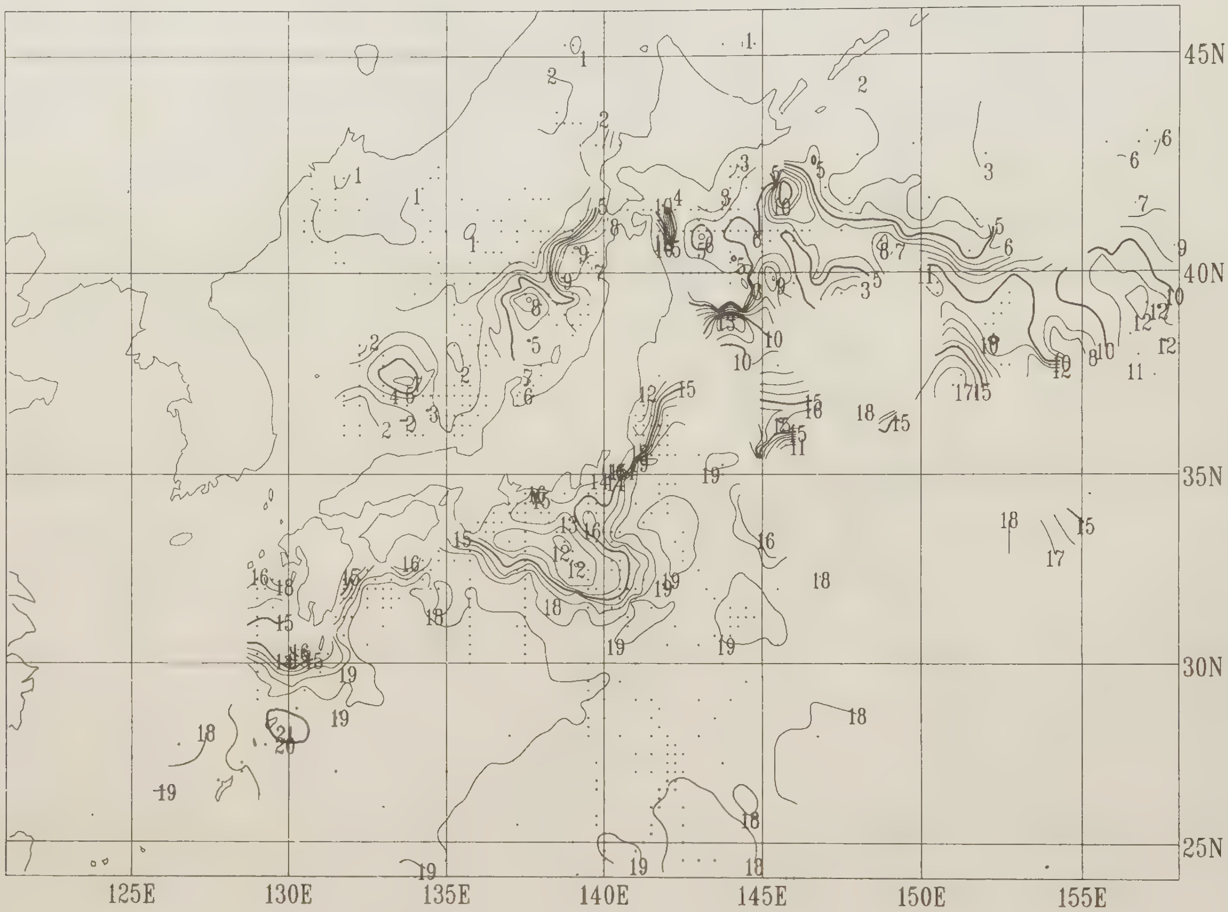
第4図 北西太平洋月平均海面水温図(上)及び偏差図(下)(1999年12月)

Fig.4 Monthly mean SST (top) and anomalies (bottom) in the western North Pacific for DEC 1999. Anomalies are computed from the JMA climatology (1961-1990). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



第5図　日本近海表層水温図(深さ100 m)(1999年12月)

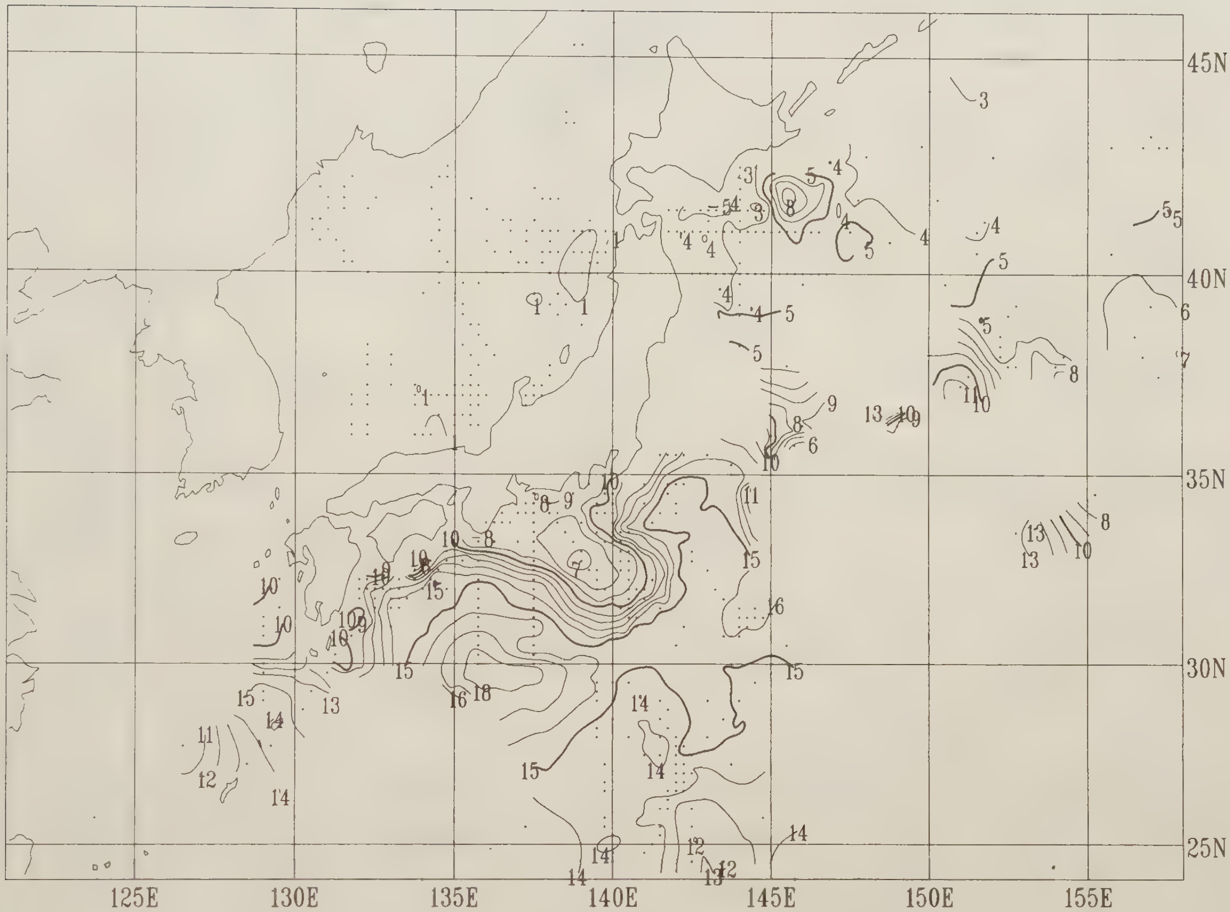
Fig.5　Subsurface (100 m) temperatures in the seas adjacent to Japan for DEC 1999.　Contour interval is 1°C.　Observation points are denoted by dots.



第6図　日本近海表層水温図(深さ200 m) (1999年12月)

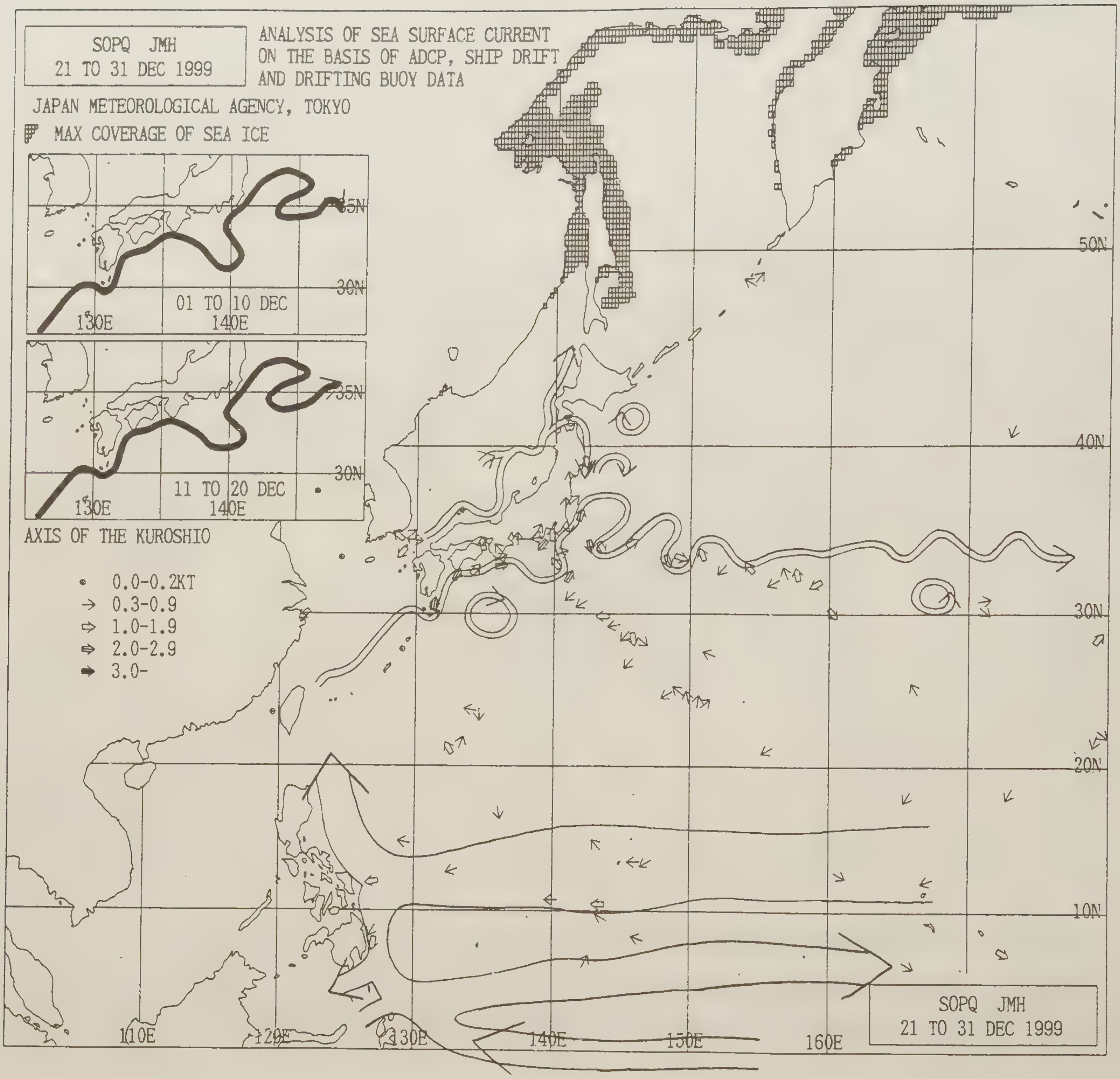
Fig.6 Subsurface (200 m) temperatures in the seas adjacent to Japan for DEC 1999. Contour interval is 1°C. Observation points are denoted by dots.

400m Temperatures in the Seas Adjacent to Japan



第7図　日本近海表層水温図(深さ400 m) (1999年12月)

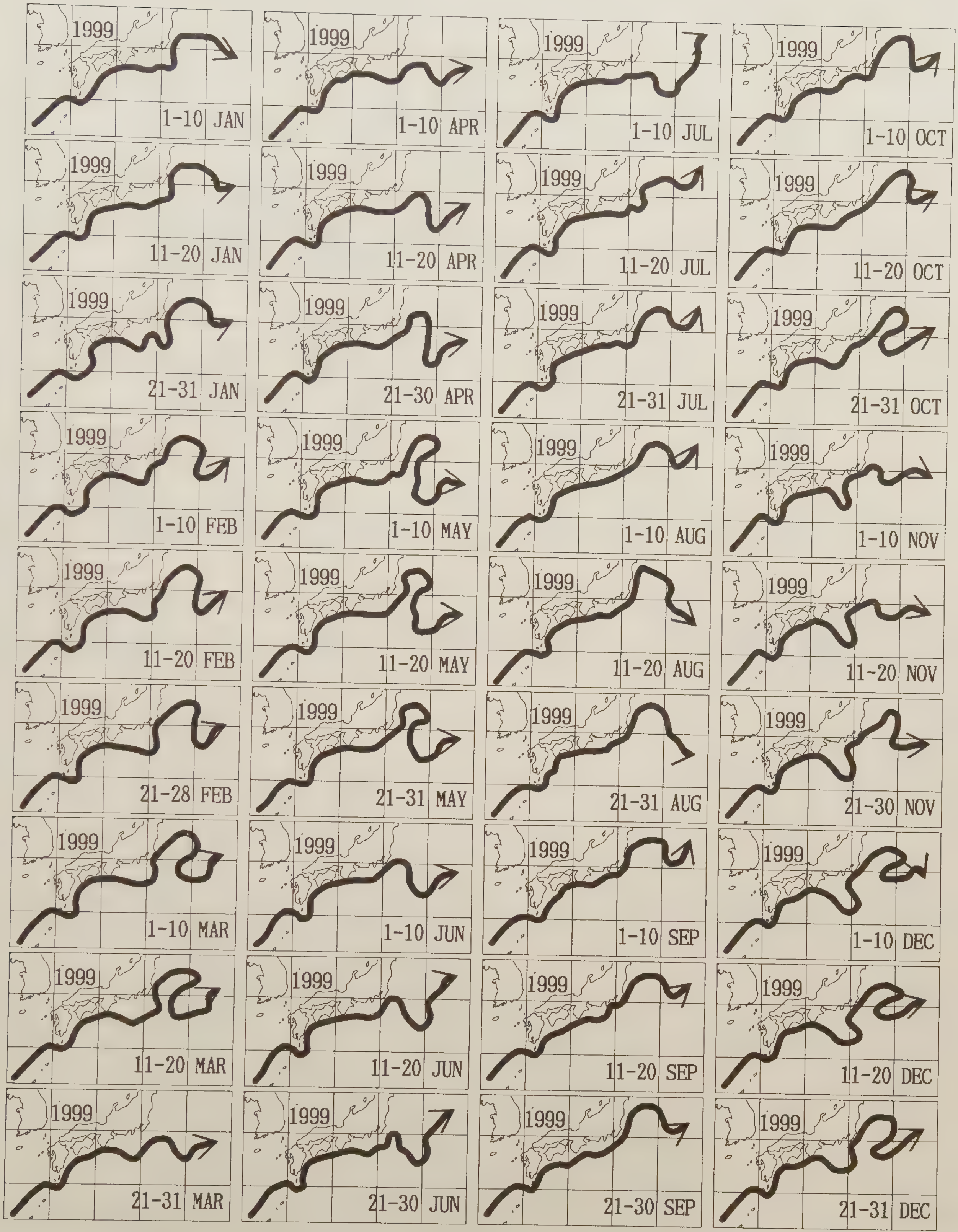
Fig.7 Subsurface (400 m) temperatures in the seas adjacent to Japan for DEC 1999. Contour interval is 1°C. Observation points are denoted by dots.



第8図　北西太平洋海流図（1999年12月下旬）

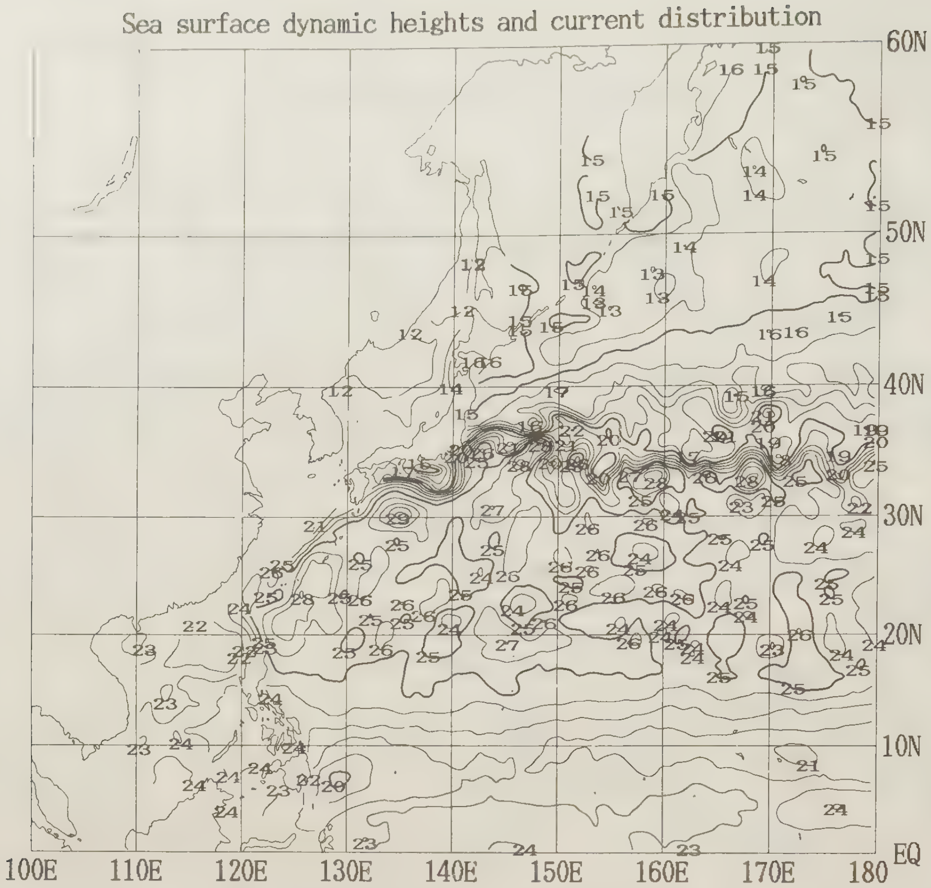
Fig. 8　Analysis of the sea surface current in the western North Pacific for the 3rd ten-day period in December 1999. Small arrows indicate *in situ* observations. Major currents such as the Kuroshio and the North Equatorial Current are denoted by larger open arrows.

Location of the Kuroshio axis



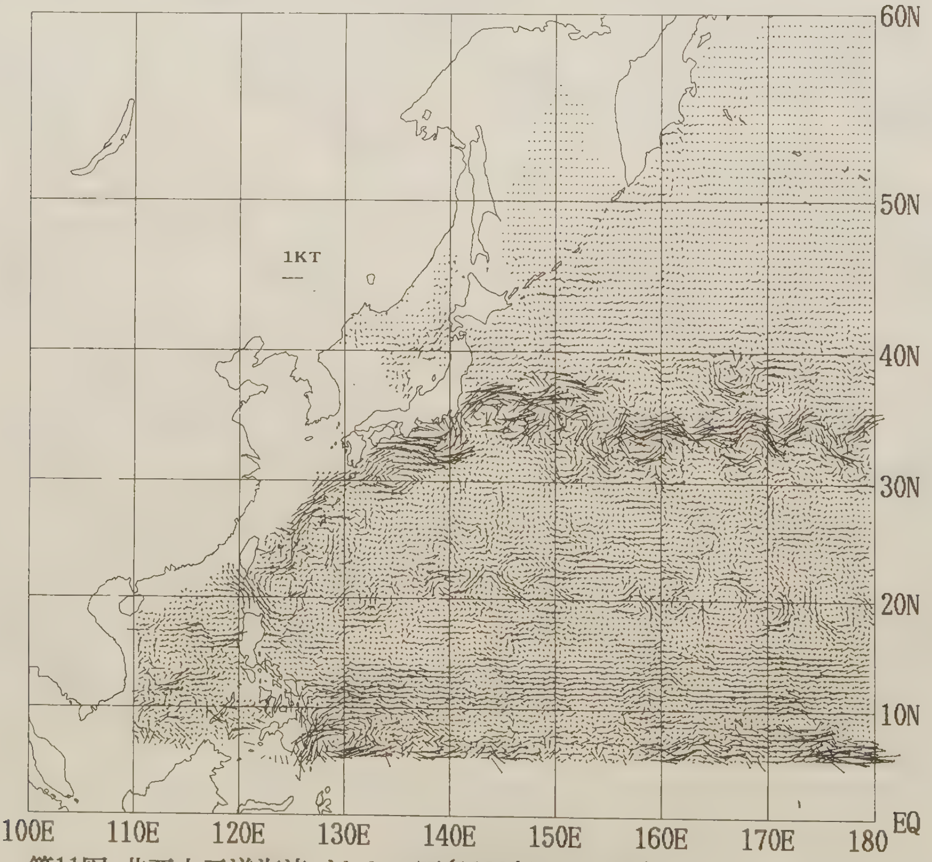
第9図 旬別黒潮流軸図

Fig.9 Location of the Kuroshio axis



第10図 北西太平洋力学的海面高度分布図(1999年12月31日)

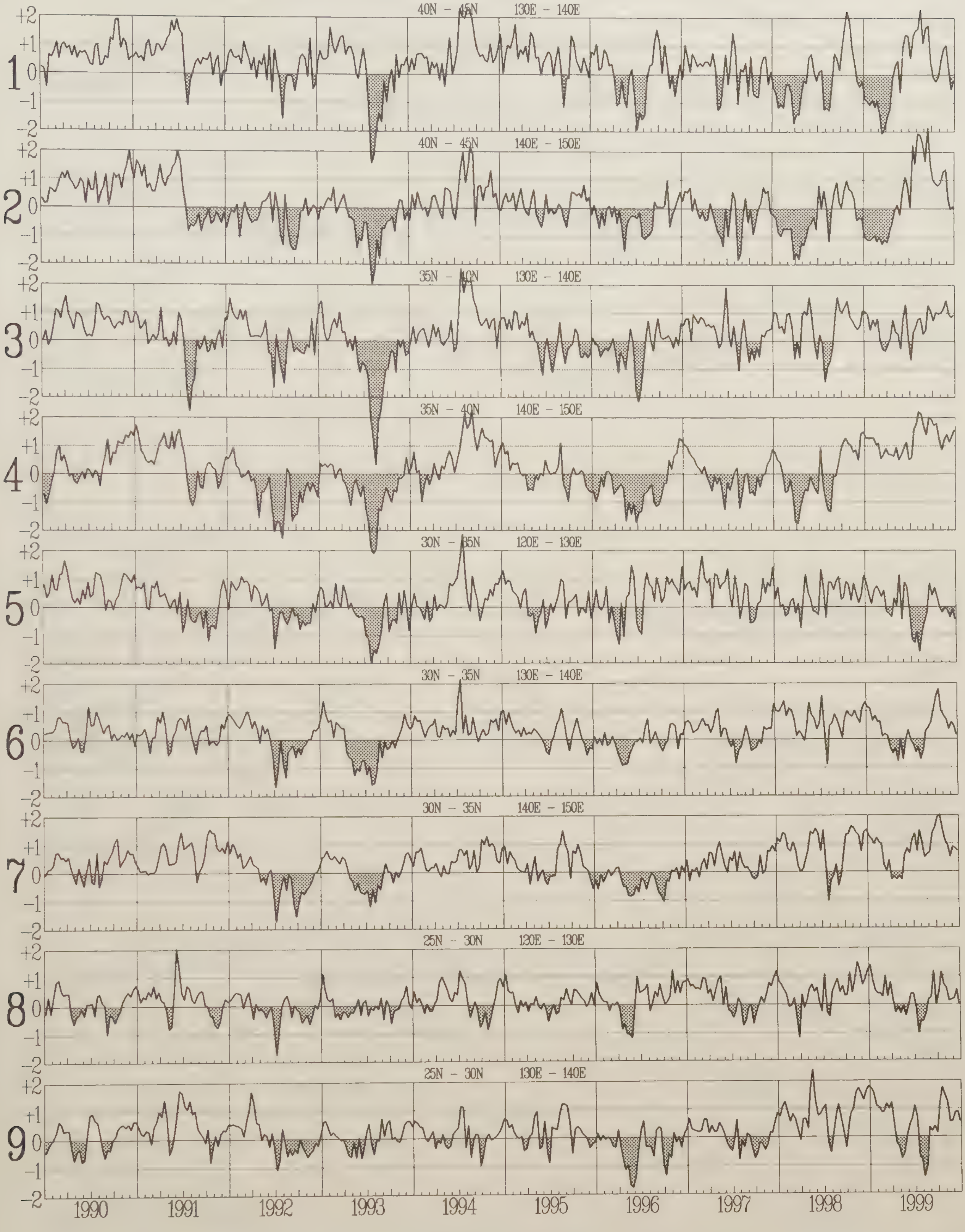
Fig.10 Sea surface dynamic heights (10cm) in the western North Pacific derived from the altimeter data of TOPEX/POSEIDON (DEC 31, 1999).
1500db surface is assumed to be the surface of no motion.



第11図 北西太平洋海流ベクトル図(1999年12月31日)

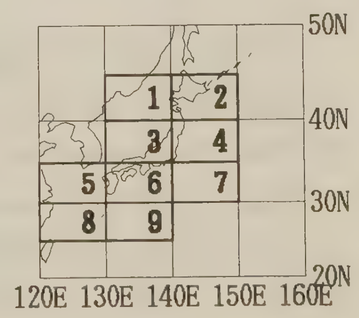
Fig.11 Sea surface current vectors in the western North Pacific (DEC 31, 1999). Vectors are derived from the sea surface dynamic heights from TOPEX/POSEIDON and subsurface temperature distribution assuming the geostrophic relation.

Time Series of Area Mean SST in the Western North Pacific

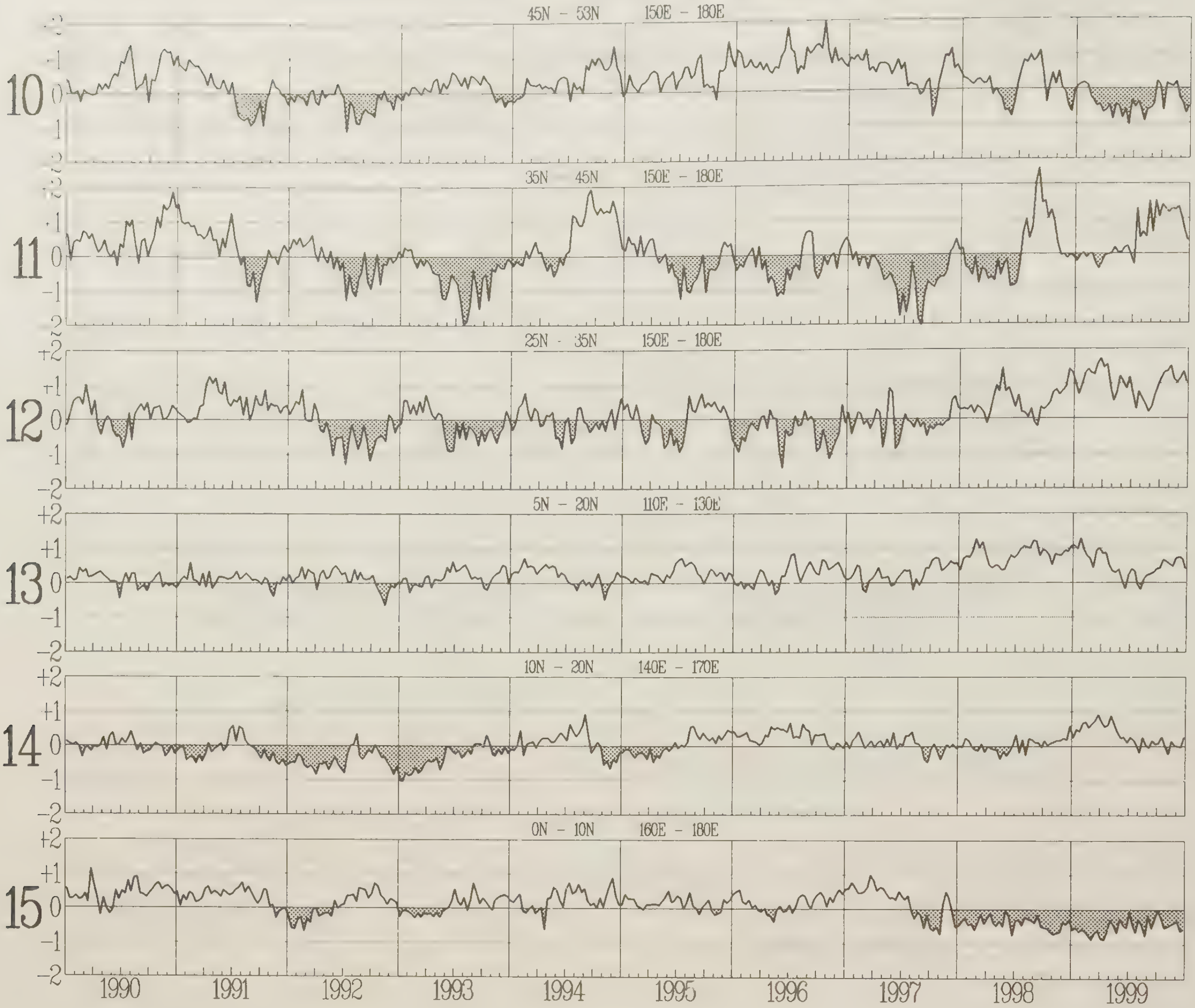


第12図　海域別旬平均海面水温平年偏差時系列図

Fig.12 Time series of the ten-day mean sea surface temperature anomalies (°C) in the western North Pacific for the areas shown in the right panel. Negative anomalies are shaded. Anomalies are computed from the JMA climatology (1961-90).

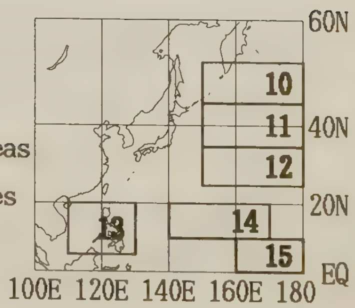


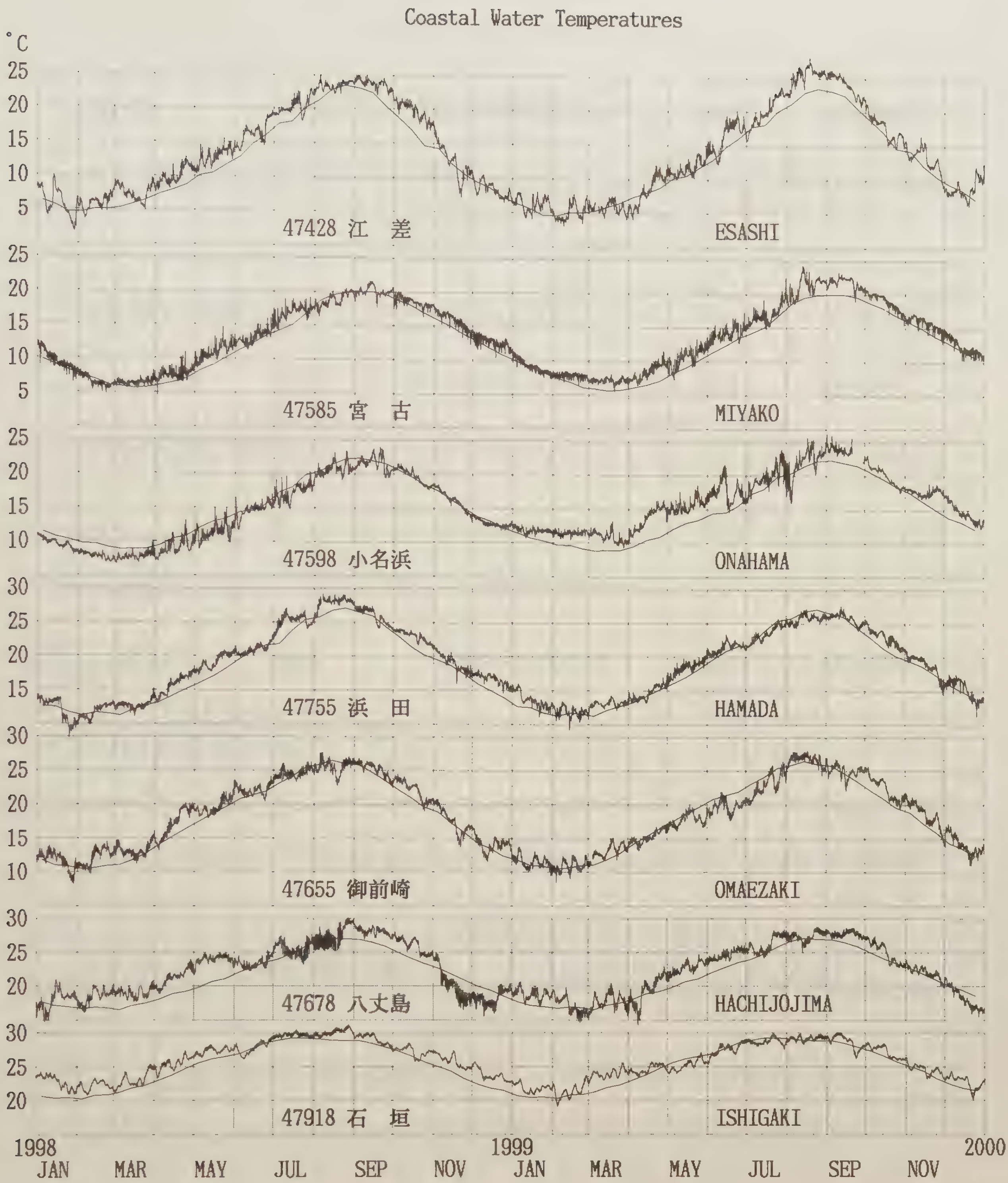
Time Series of Area Mean SST in the Western North Pacific

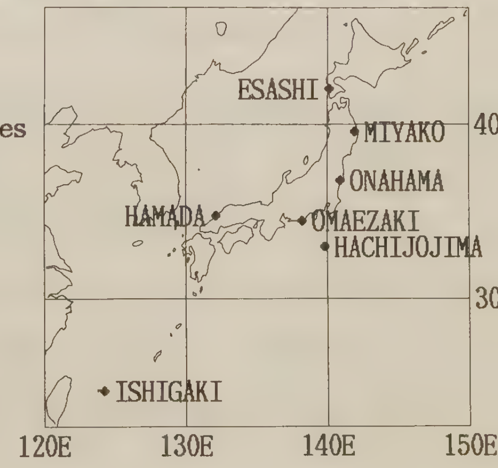


第12図　海域別旬平均海面水温平年偏差時系列図（つづき）

Fig.12 (continue) Time series of the ten-day mean sea surface temperature anomalies (°C) in the western North Pacific for the areas shown in the right panel. Negative anomalies are shaded. Anomalies are computed from the JMA climatology (1961-90).



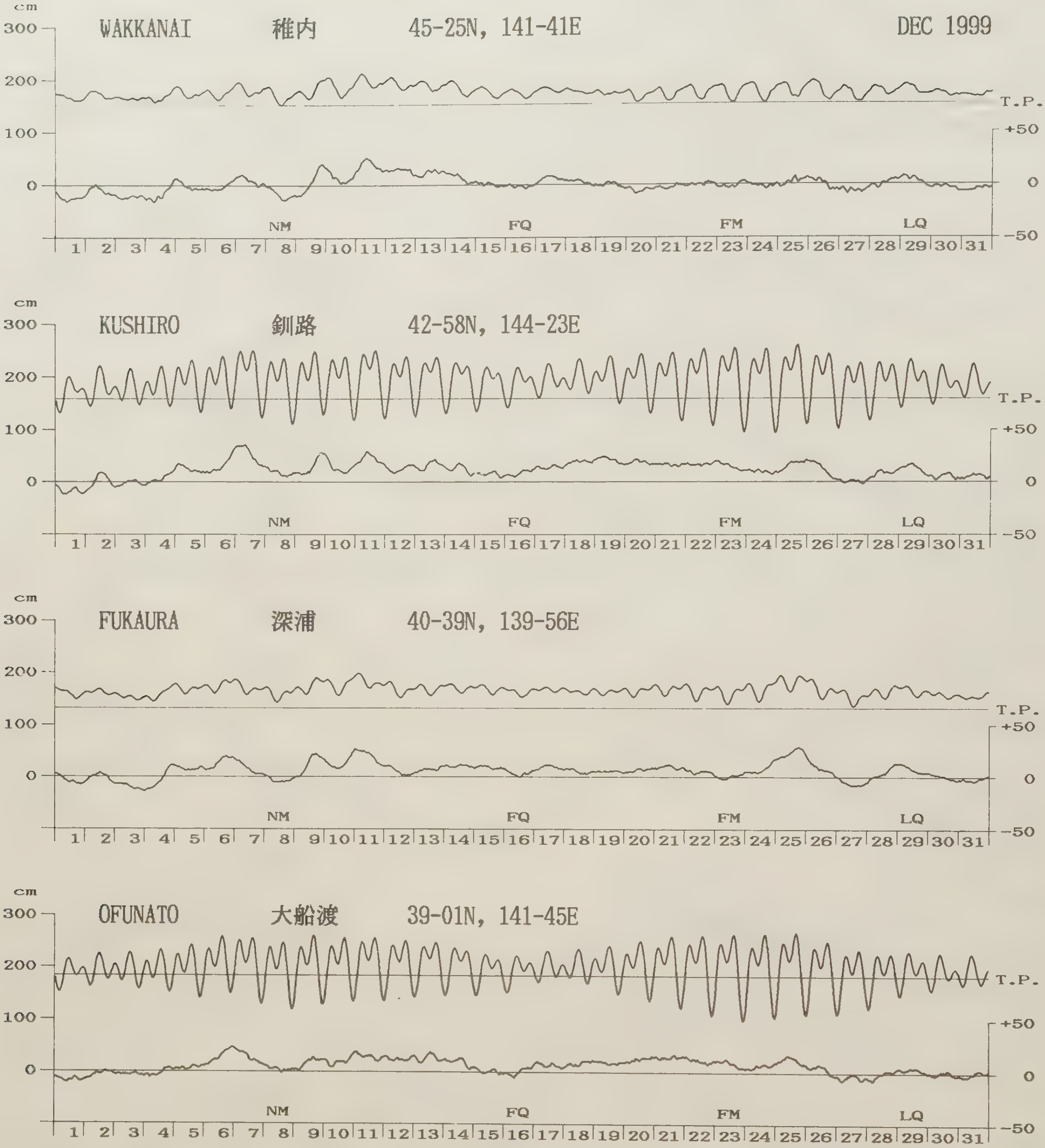




第13図 沿岸水温時系列図

Fig.13 Time series of hourly coastal water temperatures (°C) measured at 7 coastal stations of the JMA shown in the right panel.
Thin lines show ten-day mean climatology.

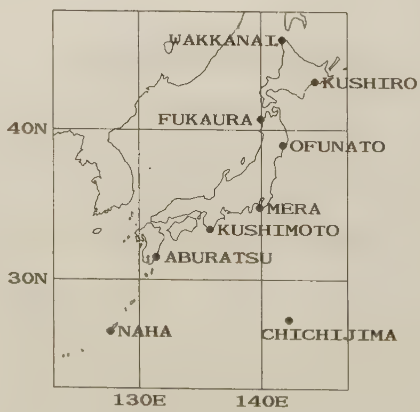
Time Series of Sea Level



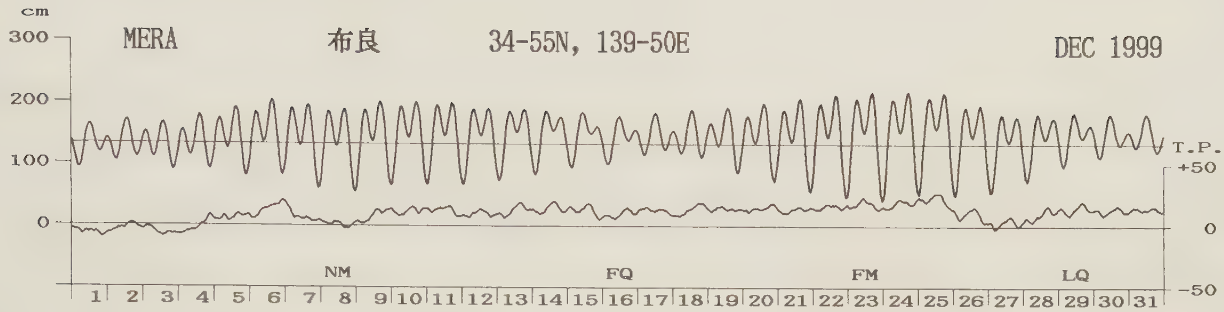
第14図 沿岸潮位時系列図 (1999年12月)

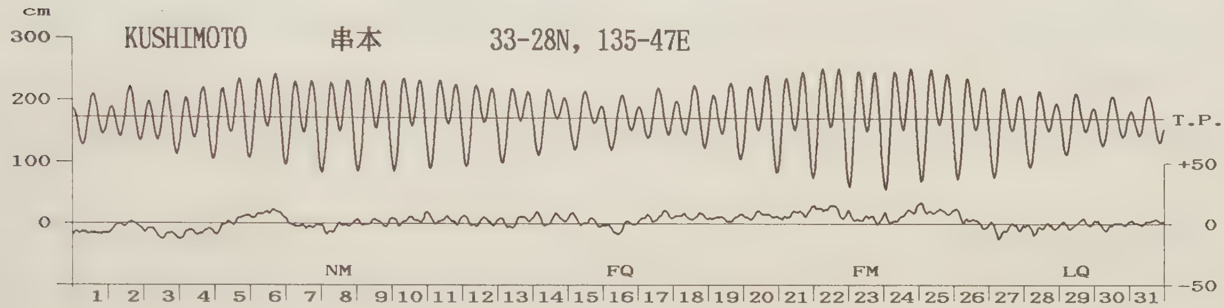
Fig.14 Time series of hourly sea level observation (upper line) and its anomalies (lower line) at 9 stations of the JMA in the right panel.
Short term variations are removed from raw data.

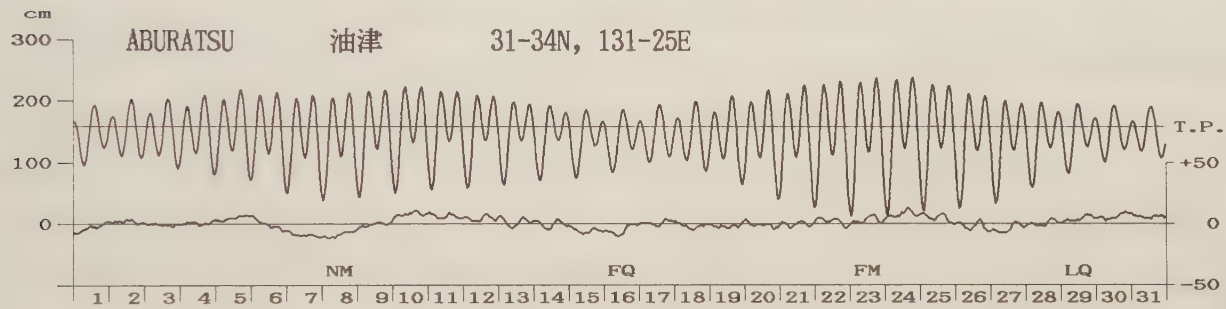
NM: new moon, FQ: first quarter
FM: full moon, LQ: last quarter
T.P.: Mean sea level of Tokyo Bay (Tokyo Peil)

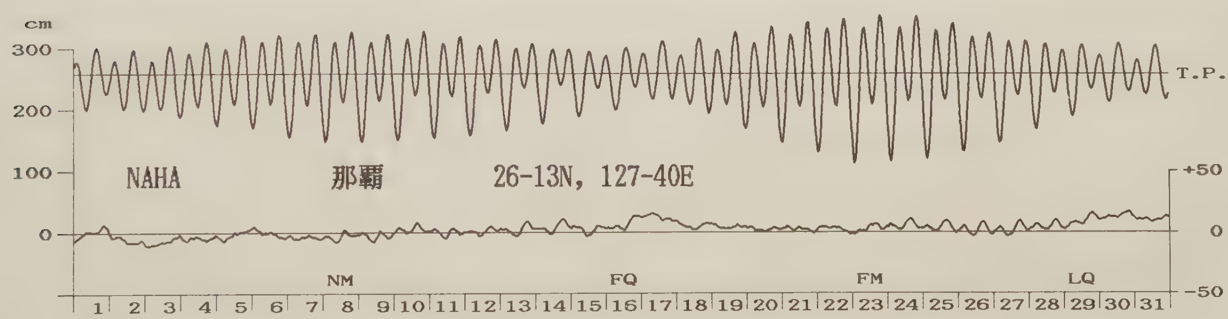


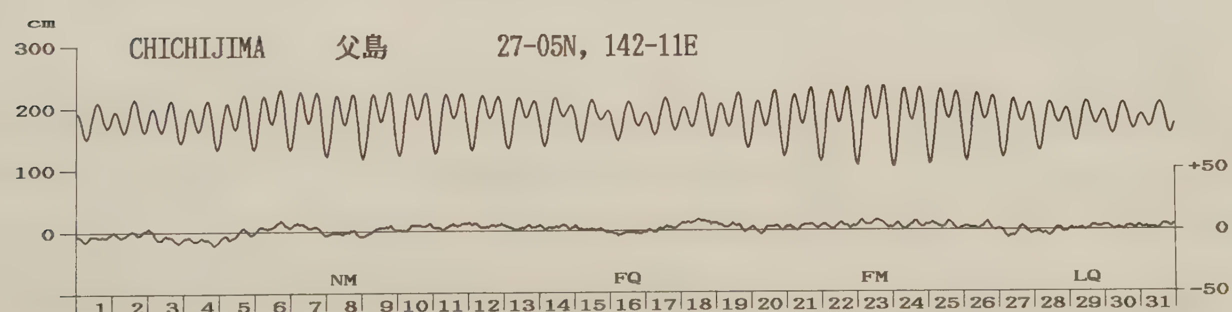
Time series of Sea Level





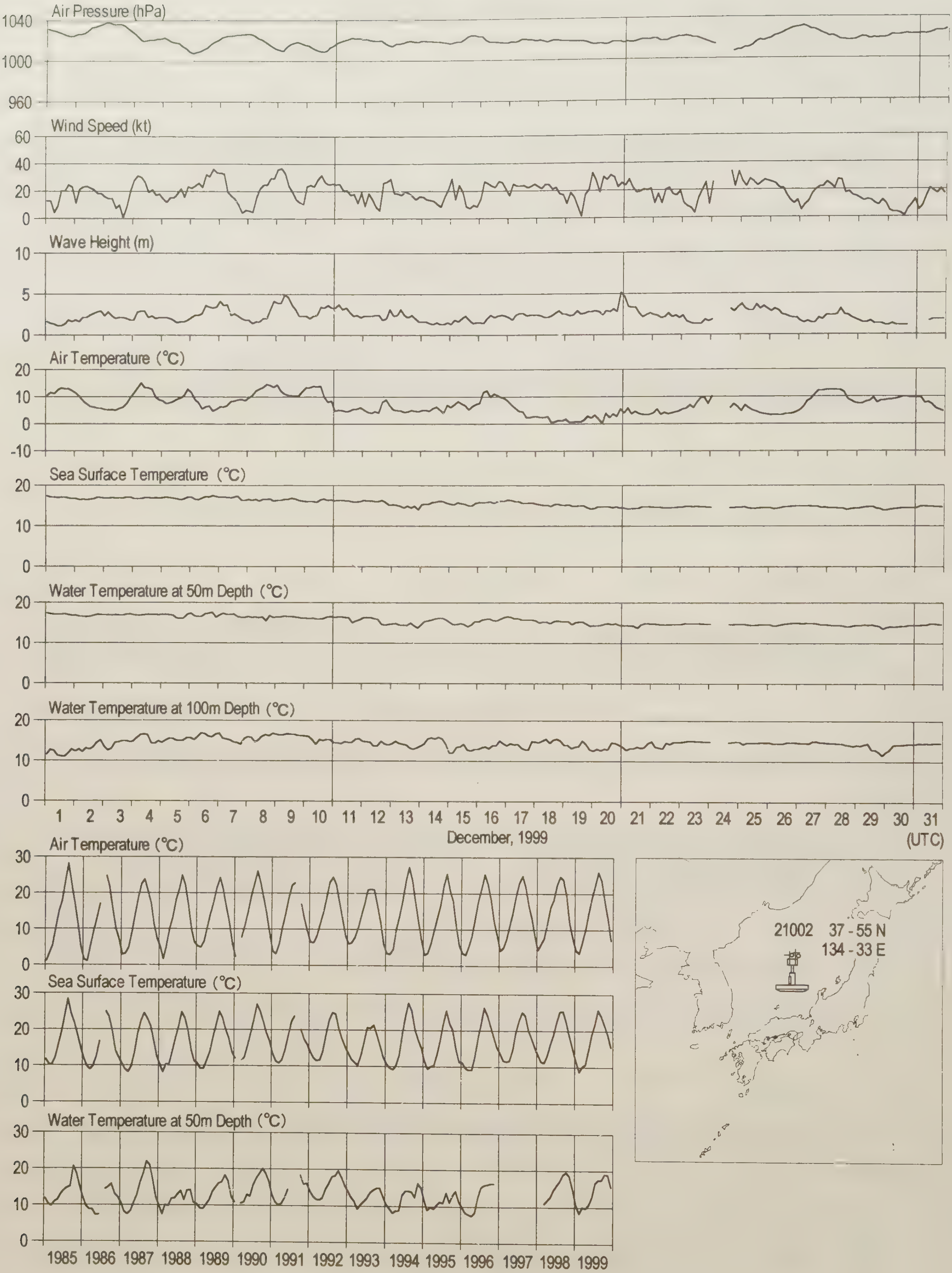






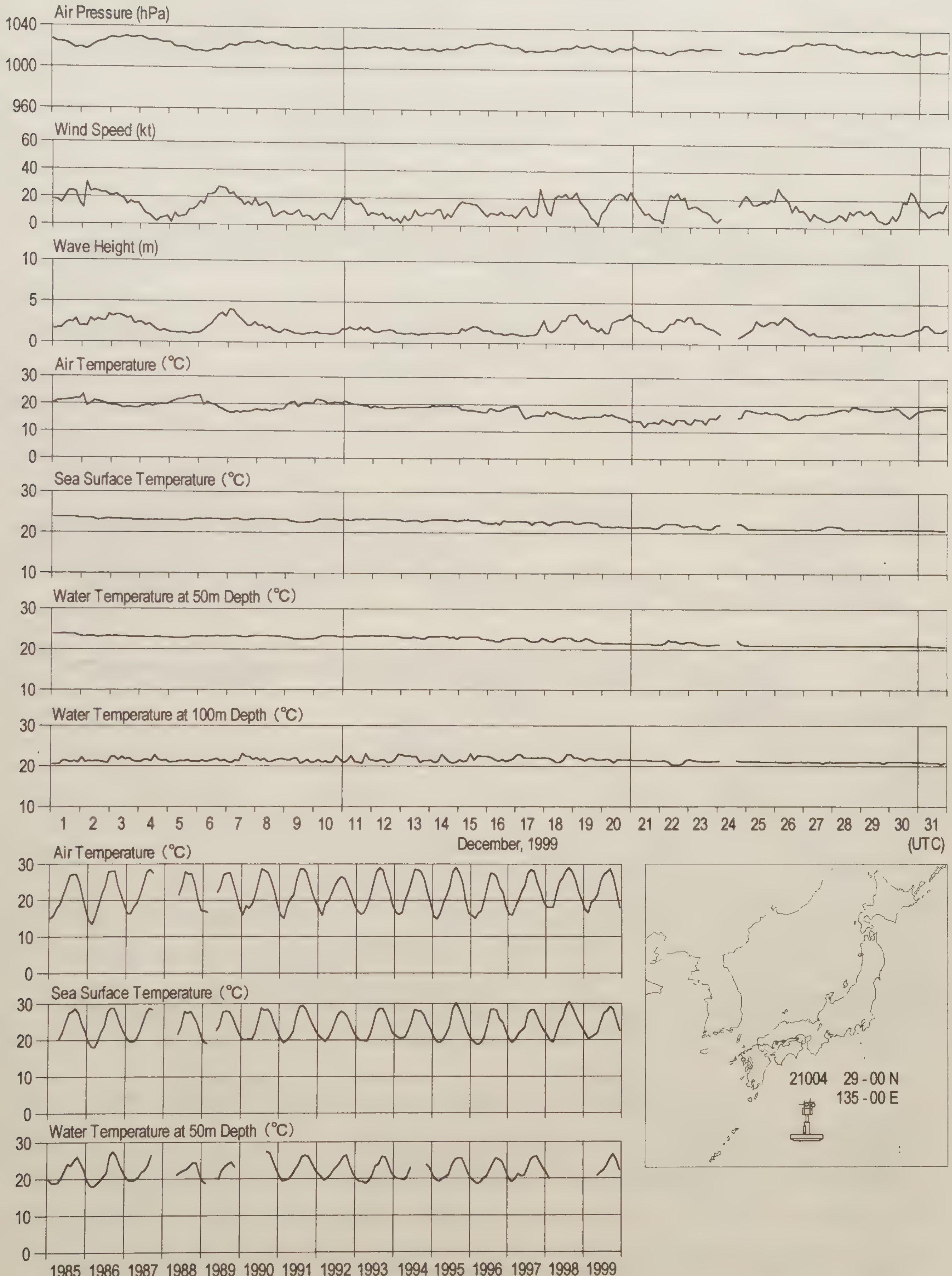
第14図 つづき

Fig.14 continue



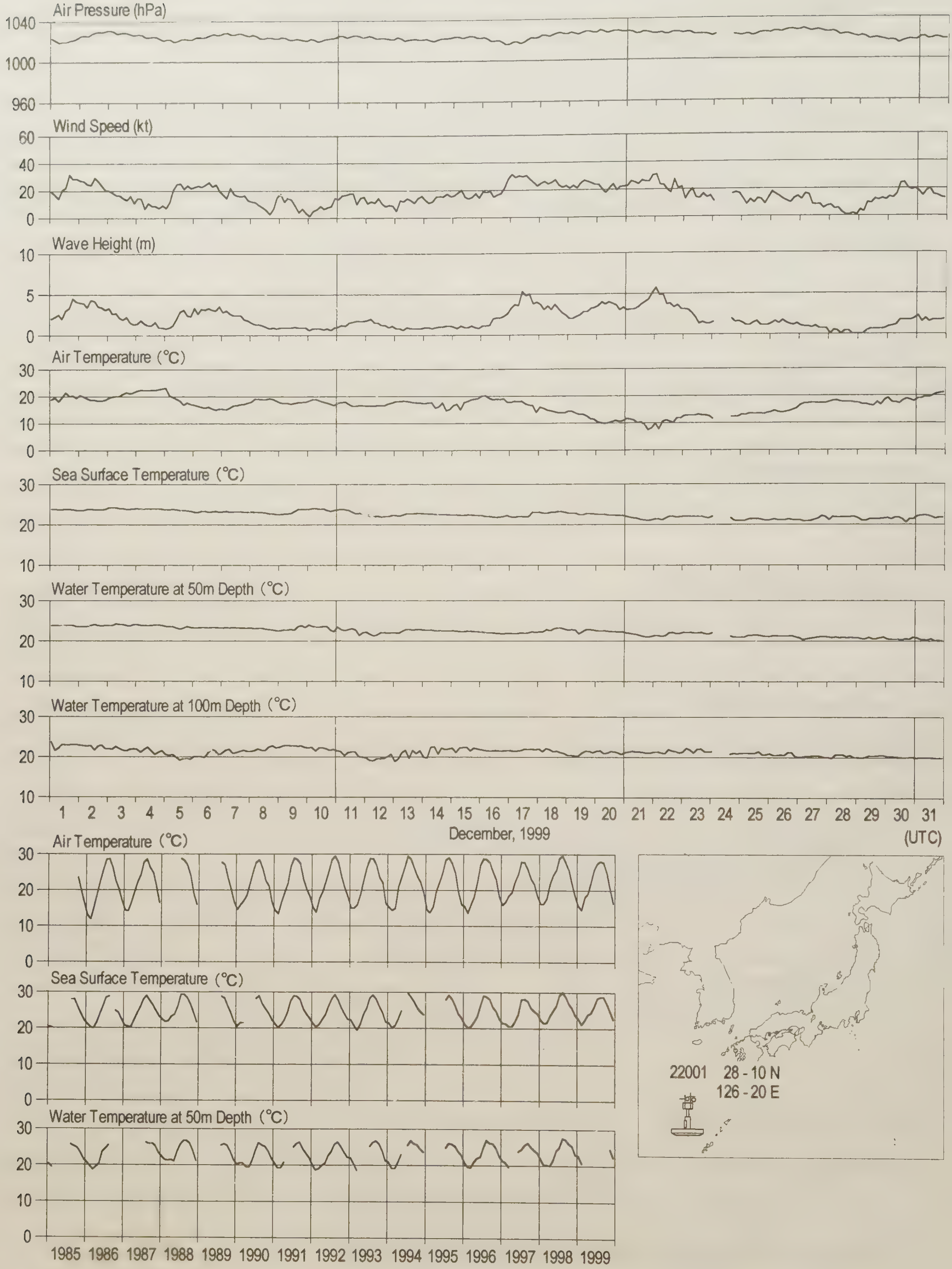
第15図　海洋気象ブイロボットによる観測要素の時系列図（日本海：21002）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig.15　Time series of JMA buoy observation in the Japan Sea (WMO ID No. 21002).
The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



第15図　海洋気象ブイロボットによる観測要素の時系列図（四国沖：21004）
上段は３時間毎の観測値を、下段は月平均値を示す。

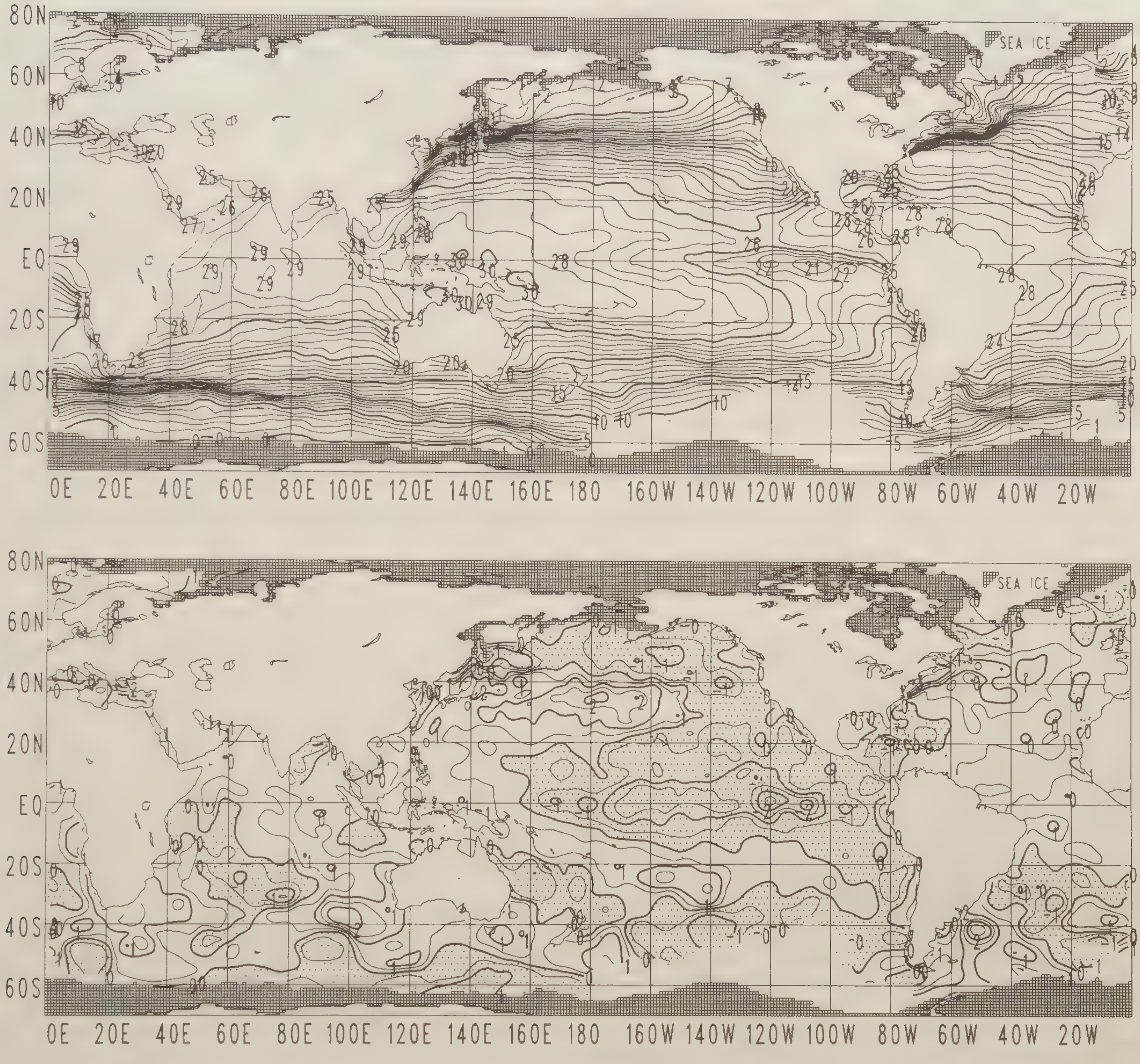
Fig.15　Time series of JMA buoy observation south of Shikoku (WMO ID No. 21004).
The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



第15図　海洋気象ブイロボットによる観測要素の時系列図（東シナ海：22001）
上段は３時間毎の観測値を、下段は月平均値を示す。

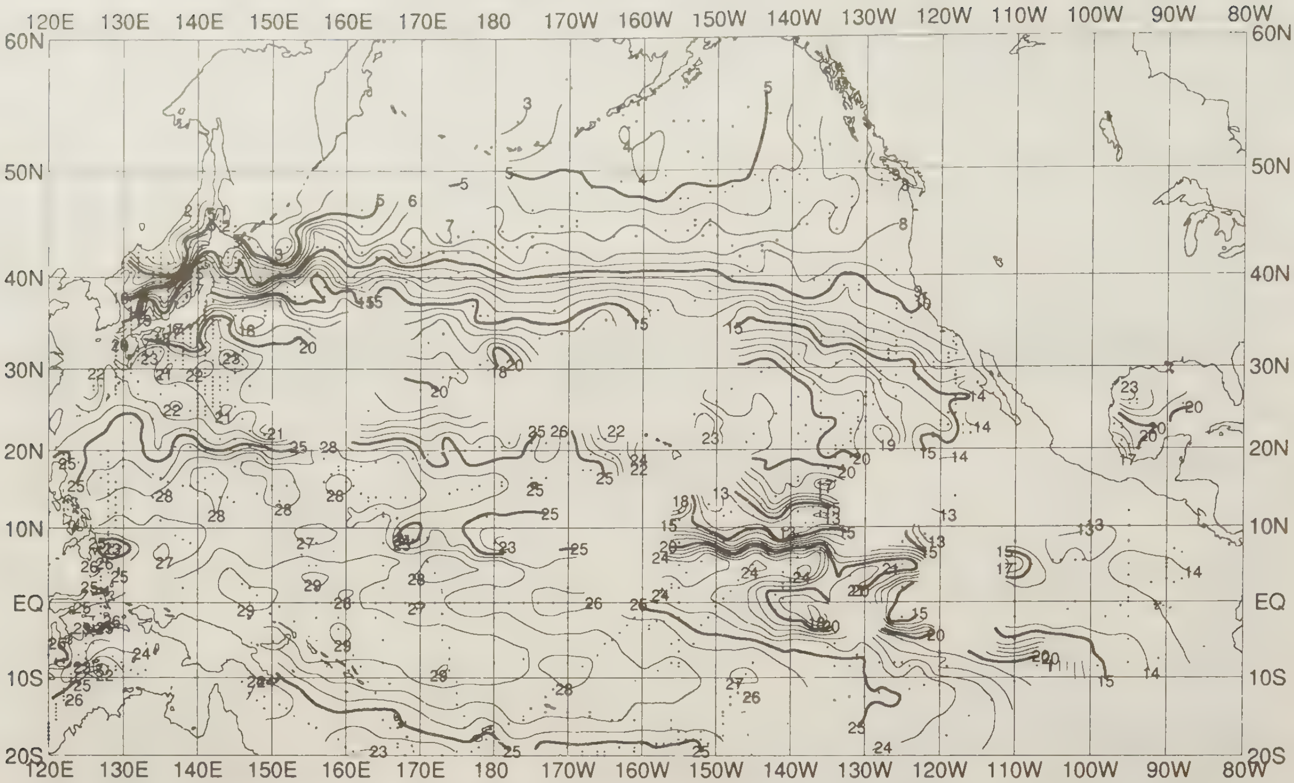
Fig.15　Time series of JMA buoy observation in the East China Sea (WMO ID No. 22001).
The upper panel shows three hourly observation and the lower panel shows the monthly mean data.

SST & Anomalies in the Global Ocean



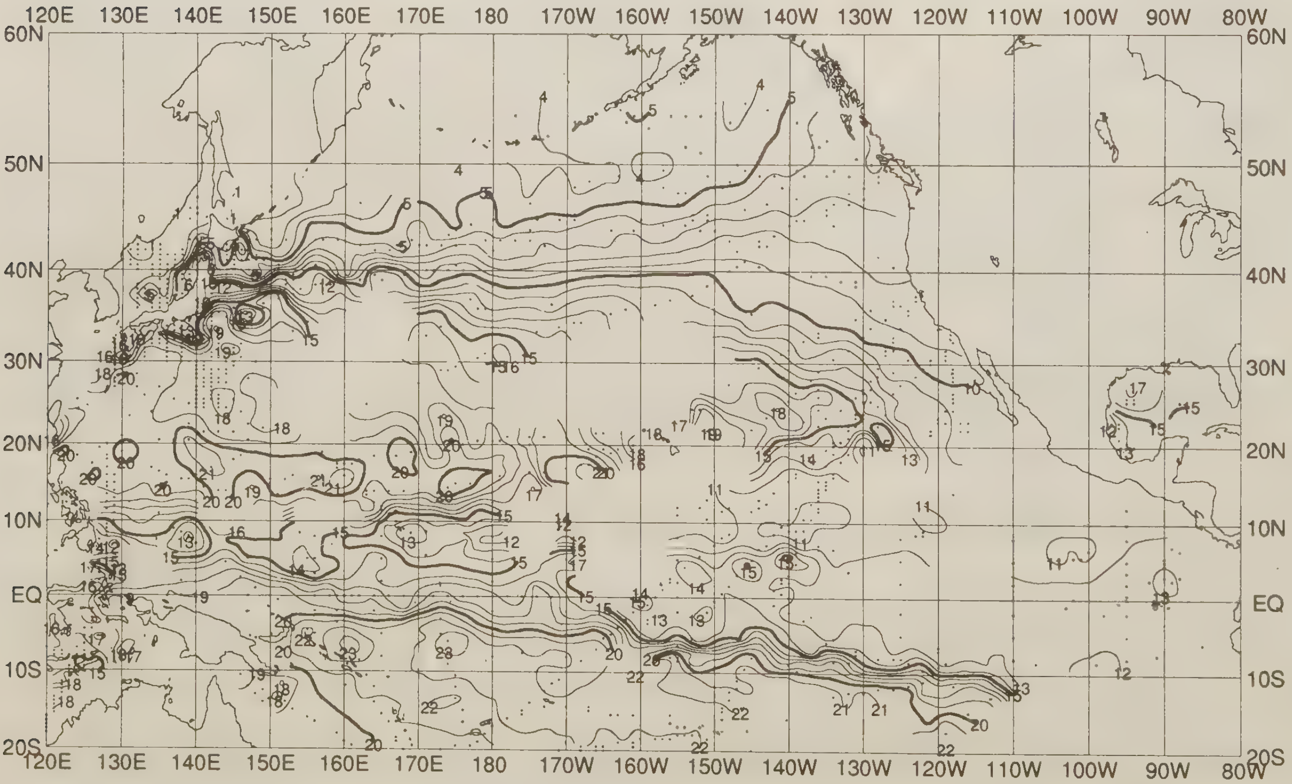
第16図　全球月平均海面水温図（上）及び偏差図（下）（1999年12月）

Fig.16 Monthly mean sea surface temperature over the global ocean (top) and anomalies (bottom) for DEC 1999. Anomalies are computed from the JMA climatology (1961-1990). Contour interval is 1°C (top) and additional anomaly contours of ±0.5°C are shown by thin lines. Negative anomalies are spotted. Maximum coverage of sea ice is shaded. Data sources for sea ice are U.S. National Ice Center (polar regions) and JMA (the Sea of Okhotsk).



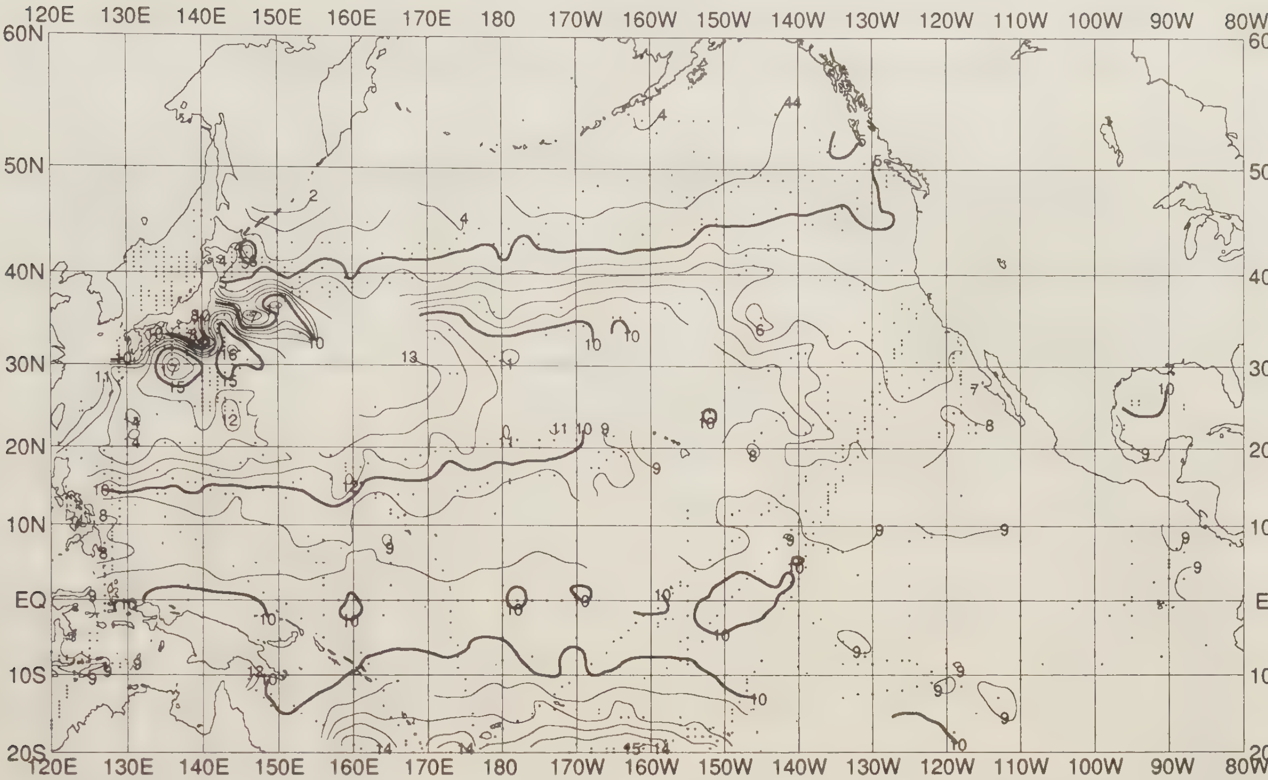
第 17 図　太平洋表層水温図（深さ 100 m）（1999 年 12 月）

Fig. 17　Subsurface (100 m) temperatures in the Pacific Ocean for December 1999. Contour interval is 1 ℃. Observation points are denoted by dots.



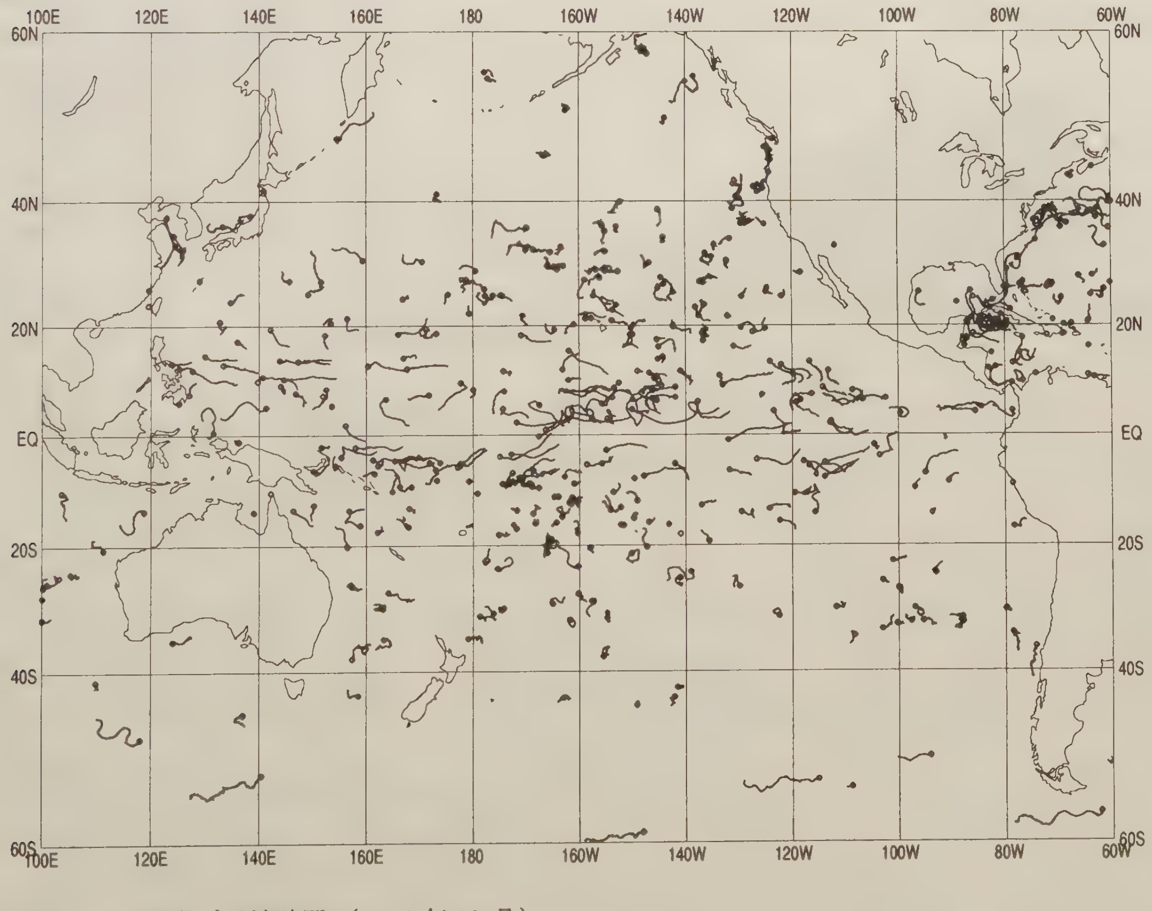
第 18 図　太平洋表層水温図（深さ 200 m）（1999 年 12 月）

Fig. 18　Subsurface (200 m) temperatures in the Pacific Ocean for December 1999. Contour interval is 1 ℃. Observation points are denoted by dots.



第 19 図　太平洋表層水温図（深さ 400 m）（1999 年 12 月）

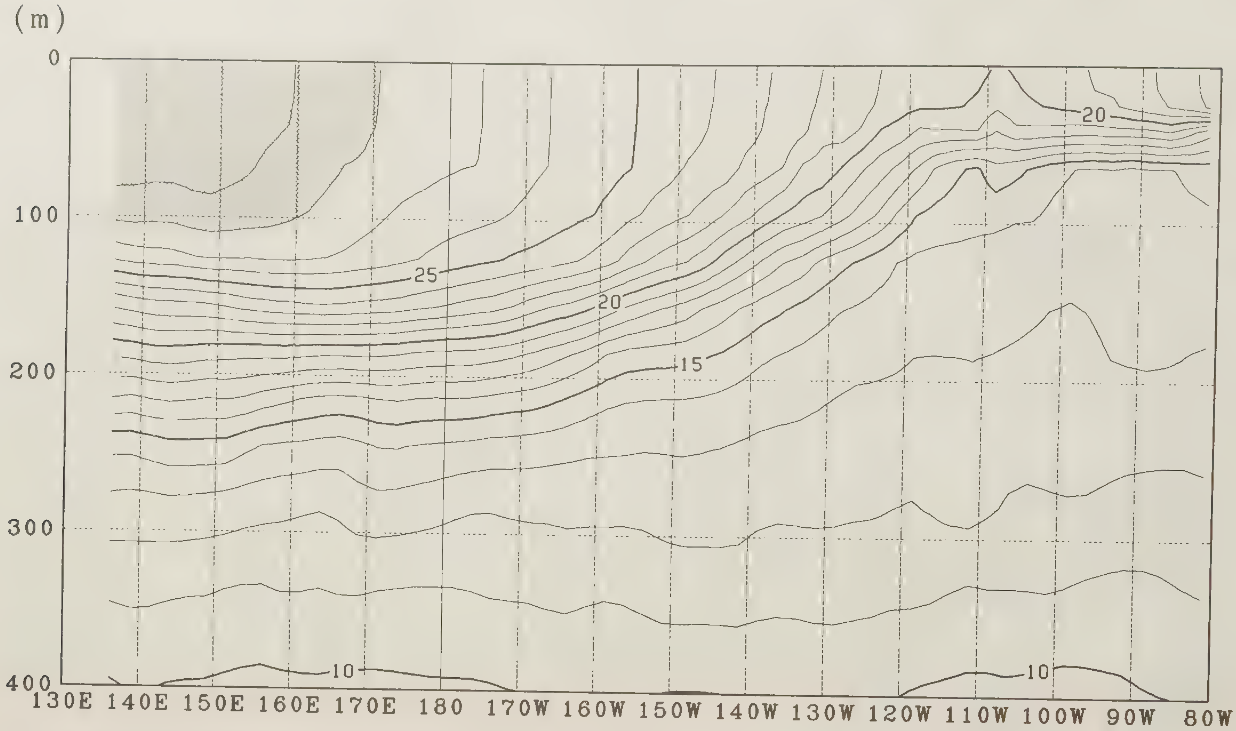
Fig. 19　Subsurface (400 m) temperatures in the Pacific Ocean for December 1999. Contour interval is 1 ℃. Observation points are denoted by dots.

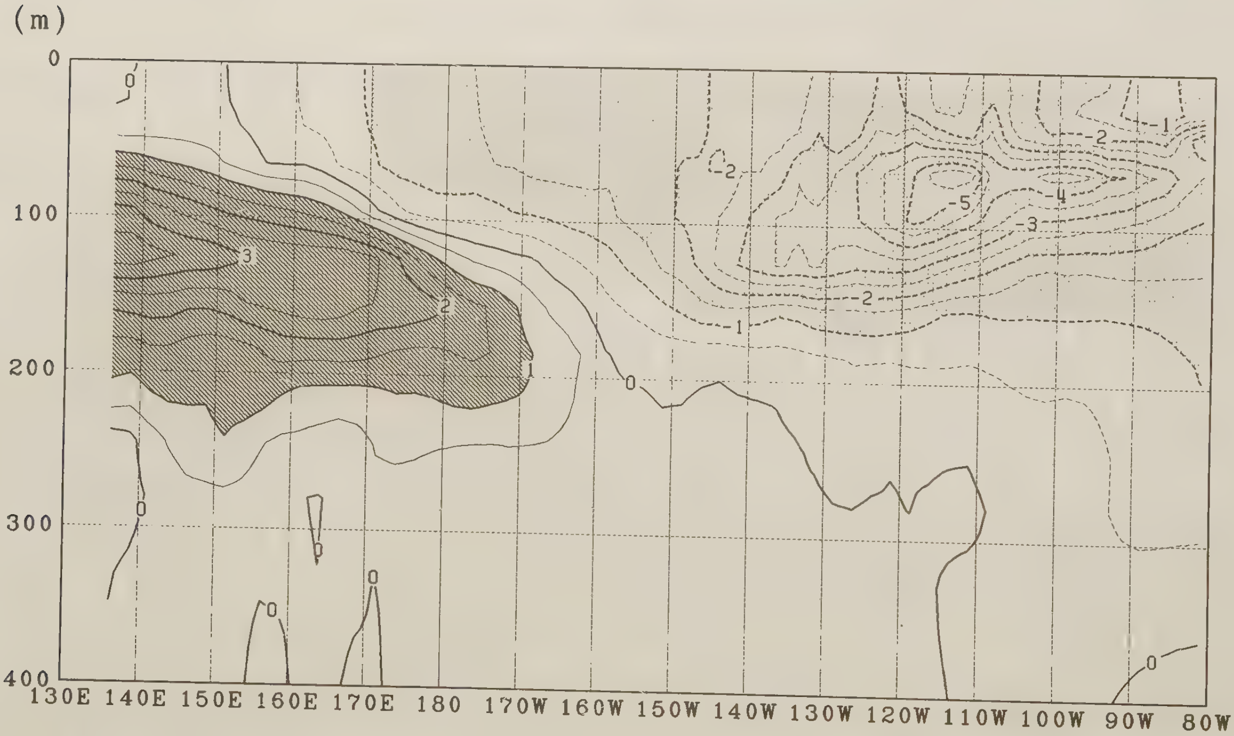


第 20 図　太平洋ブイ流跡図（1999 年 12 月）

Fig. 20　Movements of drifting buoys in the Pacific Ocean during December 1999. Each track is for one buoy. Small circles represent the last positions for the month.

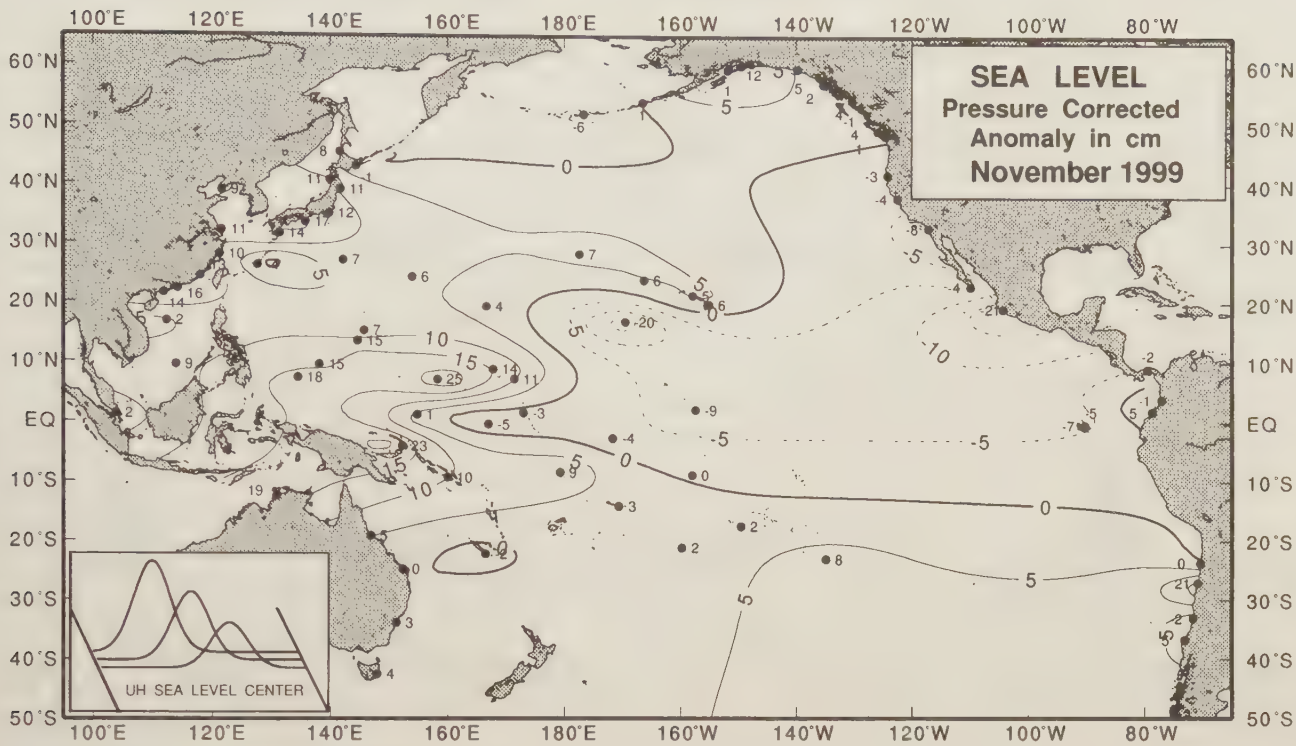
Depth-Longitude Sections of Equatorial Temperature & Anomalies





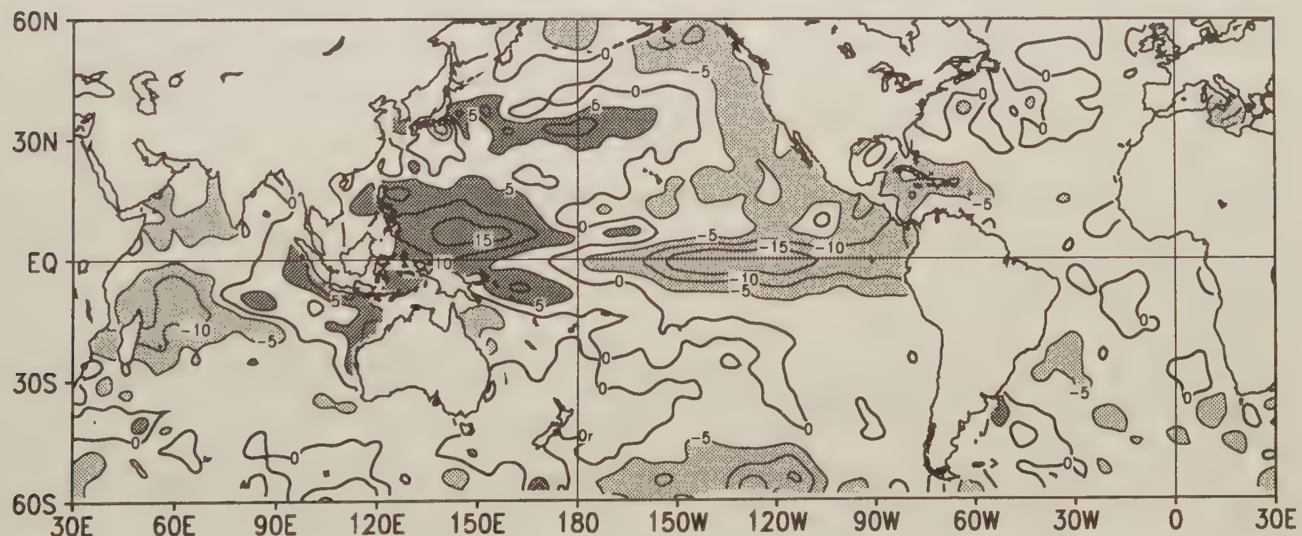
第21図　太平洋赤道に沿う表層水温（上）及び偏差（下）の深度－経度断面図（1999年12月）

Fig.21 Depth-longitude sections of temperature (top) and anomalies (bottom) along the equator in the Pacific Ocean for DEC 1999. Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C (top) and 0.5°C (bottom). Values greater than 28°C in the top panel are shaded. In the bottom panel, values greater than 1°C are shaded and values less than -1°C are spotted. Anomalies are computed from 1987-1998 base period means.



第 22 図　太平洋月平均海面水位偏差図（1999 年 11 月）

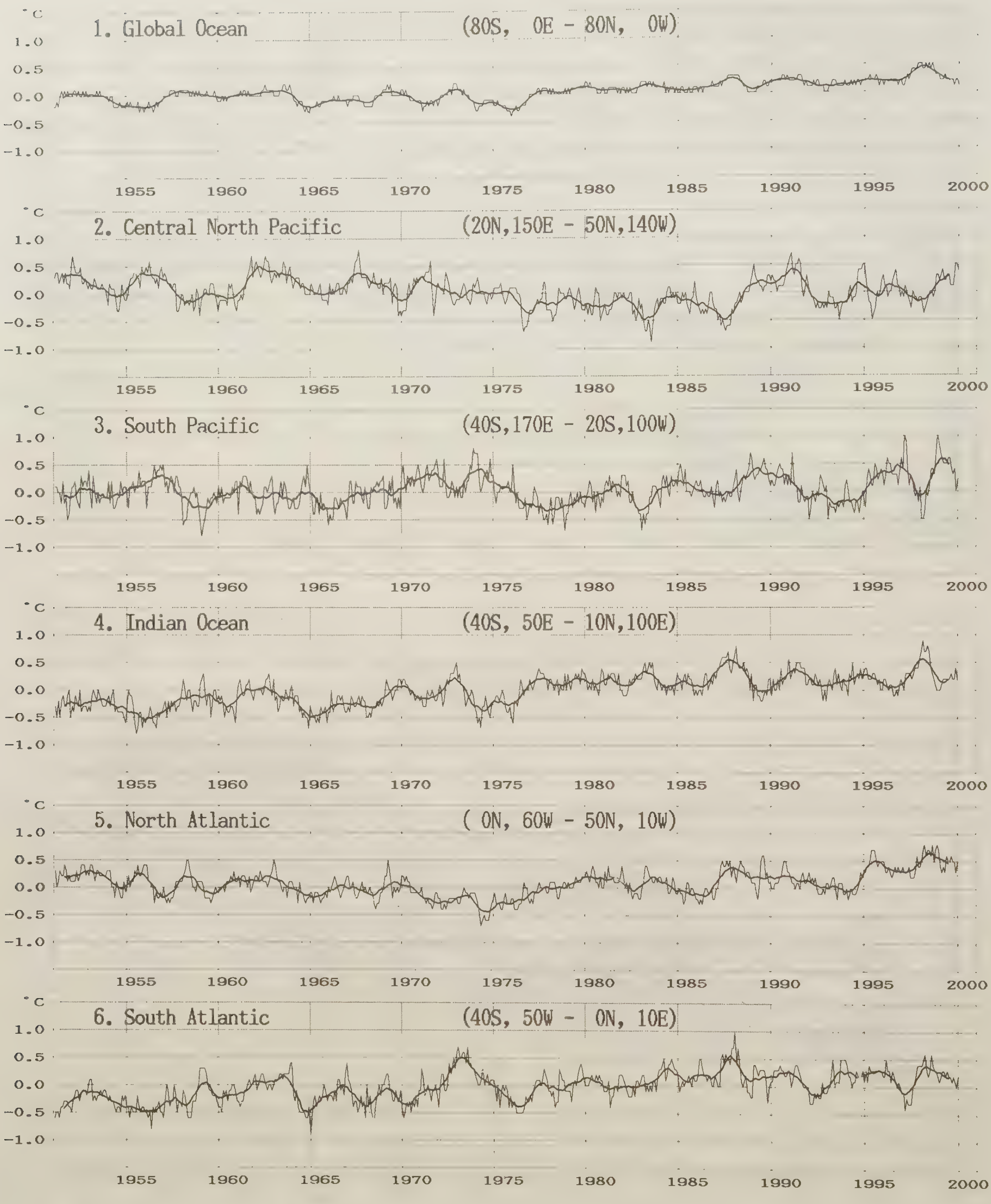
Fig. 22　Monthly sea level anomalies for November 1999 obtained from mean sea level (1975-1995) adjusted for atmospheric pressure. This figure is prepared by the SOC of ISLP-PAC, Department of Oceanography, University of Hawaii.



第 23 図　全球月平均海面高度偏差図（1999 年 11 月）

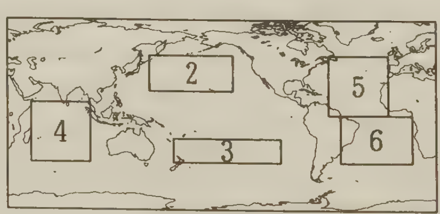
Fig. 23　Monthly sea surface height anomalies in the global ocean derived from the altimeter data of TOPEX/POSEIDON for November 1999. Contour interval is 5 cm. Positive anomalies exceeding +5 cm are shaded and negative anomalies exceeding -5 cm are spotted. Anomalies are computed from 1993-1998 base period means.

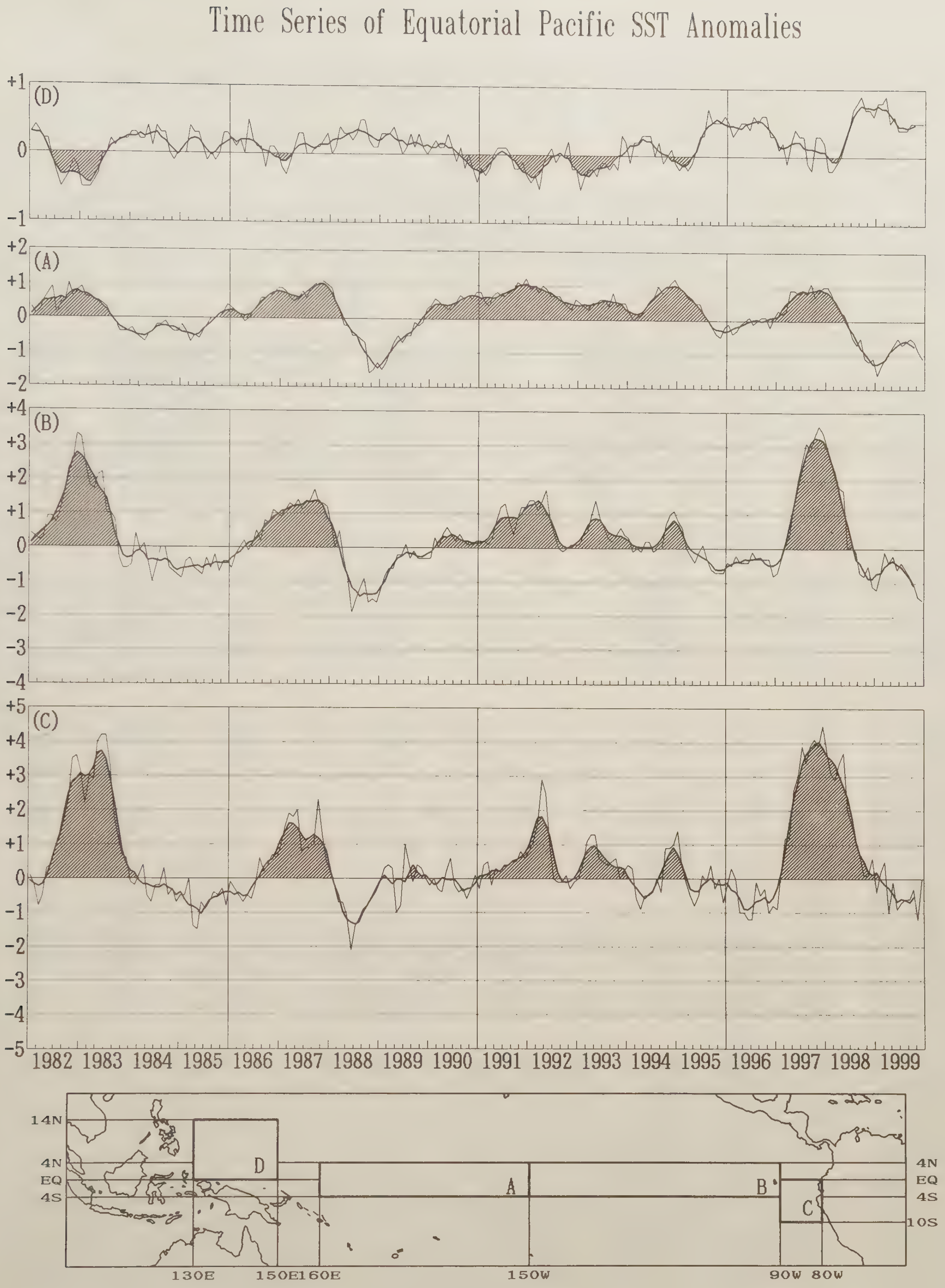
Long-term Variation of Monthly Mean SST Anomalies



第24図 海域平均海面水温偏差の長期変動

Fig.24 Long-term variations of monthly mean sea surface temperature anomalies (°C) for the areas shown in the right panel. Anomalies are computed from the JMA climatology (1961-90). Thin lines show the monthly mean and thick lines their 13-month running means.





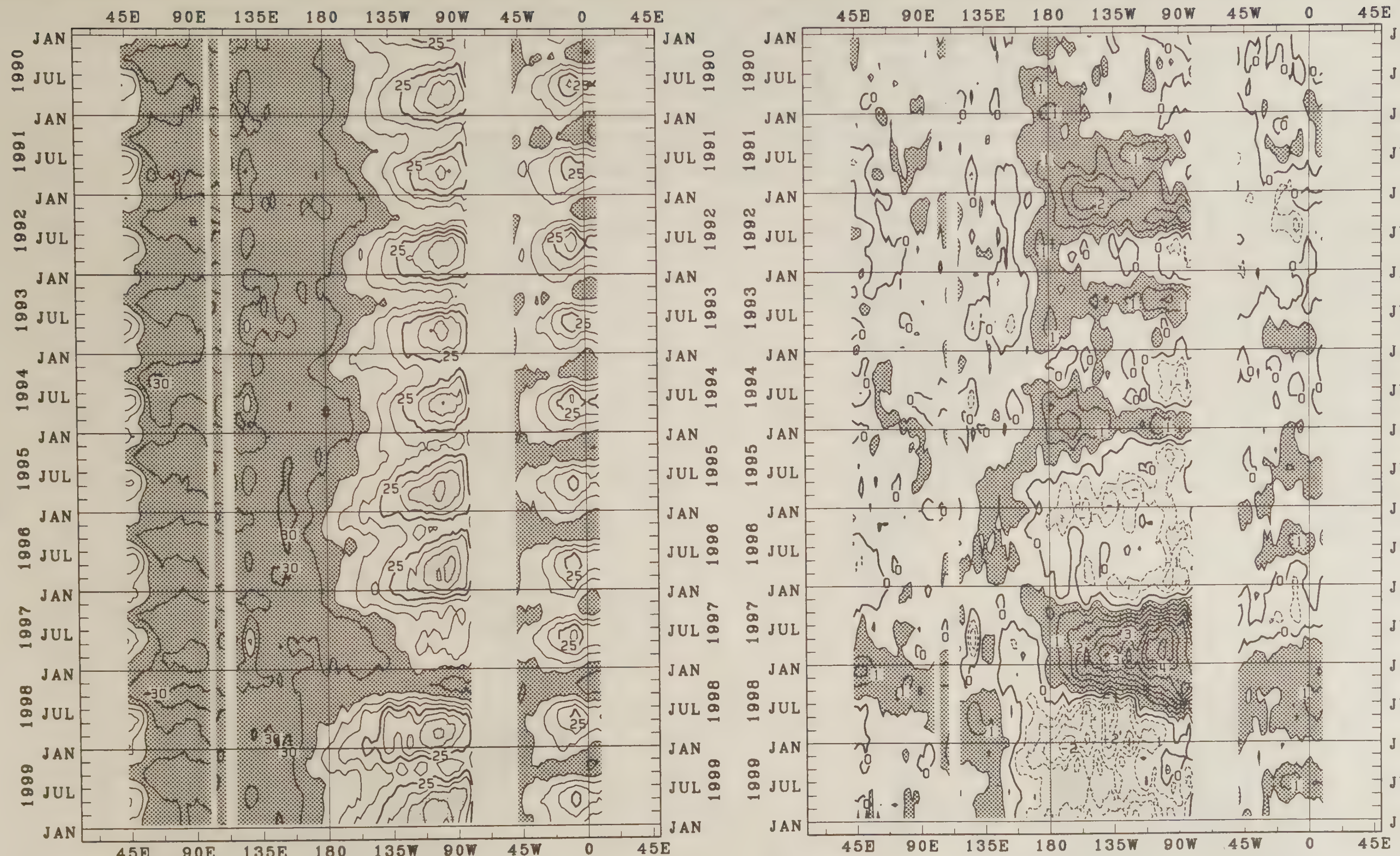
第25図　太平洋赤道域の海面水温偏差時系列図

Fig.25 Time series of monthly mean SST anomalies (°C) in the equatorial Pacific Ocean for the areas indicated at the bottom panel. Thin lines show the monthly means and thick lines their 5-month running means. Positive anomalies (A, B, C) and negative anomalies (D) are shaded. Anomalies are computed from the JMA climatology (1961-1990).

MONTH	SEA SURFACE TEMPERATURE AND ANOMALY (°C): REGION D 14N-EQ 130E-150E		REGION A 4N-4S 160E-150W		REGION B 4N-4S 150W-90W		REGION C EQ-10S 90W-80W		SOI	SEA LEVEL PRESSURE ANOMALY (hPa): TAHITI 17-33S 149-37W	DARWIN 12-24S 130-52E
JAN 97	28.6	0.1	28.3	0.3	24.7	-0.7	23.4	-0.9	0.3	1.7	0.9
FEB 97	28.5	0.2	28.2	0.2	25.9	-0.3	25.9	0.2	1.2	1.0	-1.9
MAR 97	28.3	-0.1	28.4	0.3	27.0	0.1	27.1	1.2	-0.6	-0.5	0.9
APR 97	29.0	0.2	29.1	0.9	27.5	0.4	26.3	1.2	-1.1	0.4	2.3
MAY 97	29.5	0.4	29.4	0.9	27.9	1.3	26.5	2.6	-2.5	-2.1	0.9
JUN 97	29.6	0.3	29.3	0.8	28.1	2.0	25.7	3.0	-2.3	-0.8	2.1
JUL 97	29.5	0.3	29.4	0.9	27.8	2.6	25.5	3.9	-0.8	-0.1	1.2
AUG 97	29.0	-0.1	29.2	0.8	27.7	3.1	24.0	3.4	-2.0	-0.9	2.2
SEP 97	29.0	-0.2	29.4	1.1	27.5	2.9	24.2	3.9	-1.4	0.1	2.7
OCT 97	29.6	0.3	29.1	0.7	27.9	3.3	24.8	4.1	-1.6	-0.2	2.7
NOV 97	29.5	0.3	29.3	0.9	28.2	3.6	25.4	3.9	-1.2	0.4	2.7
DEC 97	29.1	0.2	29.2	1.0	28.3	3.4	27.1	4.5	-0.9	-0.5	1.1
JAN 98	28.3	-0.2	29.0	1.0	28.4	3.0	28.0	3.7	-2.3	-3.6	1.4
FEB 98	28.1	-0.2	28.8	0.8	28.8	2.6	28.8	3.1	-1.8	-0.9	3.5
MAR 98	28.3	-0.1	28.6	0.5	29.0	2.1	28.8	2.9	-2.5	-2.8	2.3
APR 98	28.8	0.0	28.5	0.3	28.9	1.8	28.5	3.4	-2.3	-1.5	1.4
MAY 98	29.3	0.2	28.7	0.2	28.3	1.7	27.6	3.7	0.0	0.4	0.5
JUN 98	29.7	0.4	28.4	-0.1	26.1	0.0	24.7	2.0	1.1	0.9	-0.5
JUL 98	29.9	0.7	28.0	-0.5	25.3	0.1	23.2	1.6	1.5	1.8	-0.6
AUG 98	29.9	0.8	27.7	-0.7	24.5	-0.1	21.7	1.1	1.0	1.4	-0.2
SEP 98	30.1	0.9	27.8	-0.5	23.9	-0.7	21.0	0.7	1.0	1.4	-0.4
OCT 98	30.0	0.7	27.3	-1.1	23.8	-0.8	20.8	0.1	1.2	0.8	-1.1
NOV 98	29.9	0.7	27.2	-1.2	24.1	-0.5	21.6	0.1	1.0	0.4	-1.5
DEC 98	29.5	0.6	27.1	-1.1	23.8	-1.1	23.2	0.6	1.5	1.1	-1.5
JAN 99	29.3	0.8	26.4	-1.6	24.2	-1.2	23.9	-0.4	1.5	1.8	-1.5
FEB 99	29.1	0.8	26.7	-1.3	25.5	-0.7	25.9	0.2	0.8	1.3	-0.6
MAR 99	29.3	0.9	27.0	-1.1	26.8	-0.1	26.4	0.5	0.8	0.4	-1.3
APR 99	29.3	0.5	27.3	-0.9	26.7	-0.4	24.1	-1.0	1.8	1.3	-0.9
MAY 99	29.7	0.6	27.8	-0.7	26.4	-0.2	23.8	-0.1	0.3	1.1	1.1
JUN 99	29.7	0.4	28.0	-0.5	25.5	-0.6	21.8	-0.9	0.1	0.6	0.4
JUL 99	29.6	0.4	27.8	-0.7	24.8	-0.4	20.9	-0.7	0.5	1.0	0.1
AUG 99	29.5	0.4	27.8	-0.6	24.0	-0.6	20.0	-0.6	0.0	1.3	1.1
SEP 99	29.7	0.5	27.8	-0.5	23.8	-0.8	19.7	-0.6	-0.1	0.2	0.4
OCT 99	29.8	0.5	27.8	-0.6	23.6	-1.0	20.4	-0.3	1.1	1.2	-0.4
NOV 99	29.7	0.5	27.5	-0.9	23.2	-1.4	20.3	-1.2	1.1	1.2	-0.9
DEC 99	29.4	0.5	27.1	-1.1	23.4	-1.5	22.6	0.0	1.5	1.9	-0.9

第1表　エルニーニョ監視指数

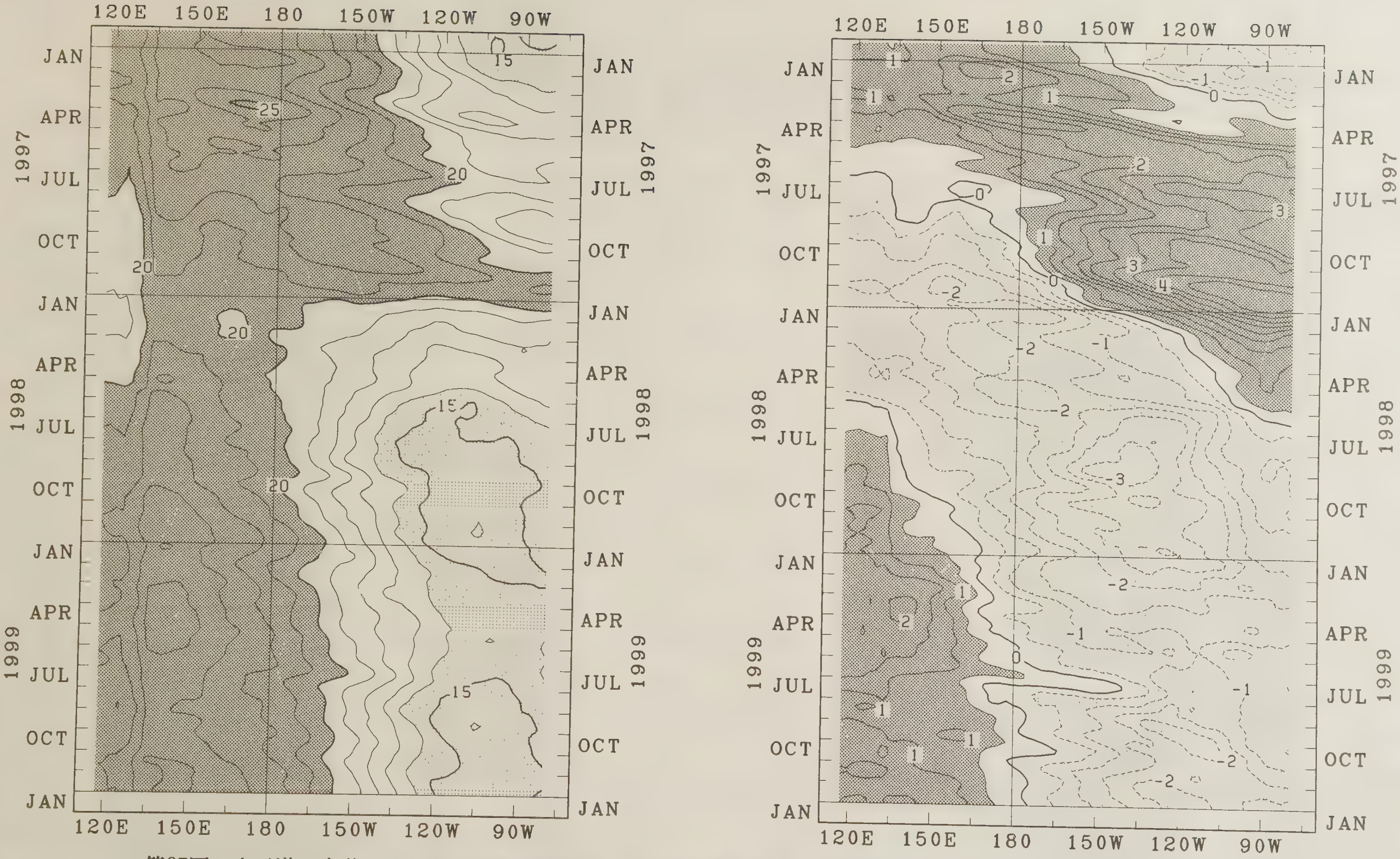
Table 1　El Nino Monitoring indices



第 26 図　赤道に沿った海面水温（左）及び偏差（右）の時間-経度断面図

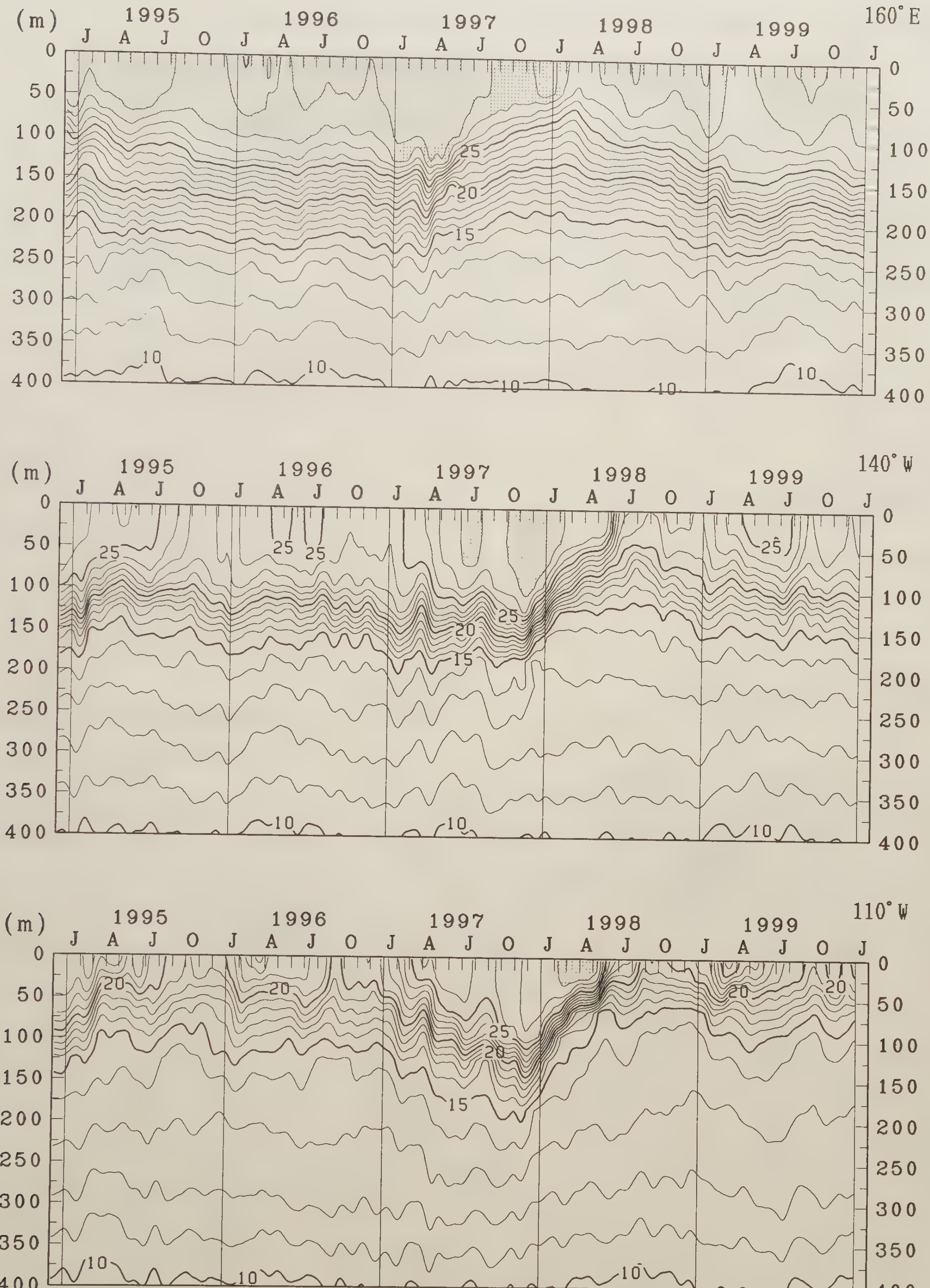
Fig. 26　Time-longitude sections of SSTs (left) and anomalies (right) along the equator (2 °N-2 °S) in the global ocean. Contour interval is 1 °C (left) and 0.5 °C (right). Values greater than 28 °C are shaded and values less than 23 °C are spotted in the left panel. Dashed contours indicate negative anomalies in the right panel. Anomalies are computed from 1961-1990 base period means.

Time-Longitude Sections of Ocean Heat Content & Anomalies (Eq.)



第27図　太平洋の赤道に沿う海洋表層の貯熱量（左）及び偏差（右）の時間－経度断面図

Fig.27 Time-longitude sections of ocean heat content in the upper 260 m along the equator (left) and anomalies (right) in the Pacific Ocean. Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C (left) and 0.5°C (right). Values greater than 20°C are shaded and values less than 16°C are spotted in the left panel. Dashed contours indicate negative anomalies in the right panel. Anomalies are computed from 1987-1998 base period means.



第28図　太平洋赤道域の表層水温の時間－深度断面図
（上：西部、中：中部、下：東部）

Fig.28 Time-depth sections of equatorial subsurface temperature for the western Pacific (top, 160°E), the central Pacific (middle, 140°W) and the eastern Pacific (bottom, 110°W). Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C. Values greater than 28°C are shaded.

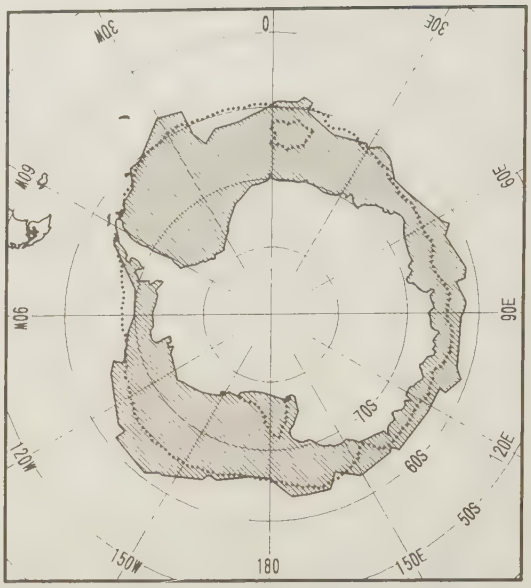


第29-1図　北極域の海氷図（1999年12月16日）

Fig.29-1 Sea ice chart in the Arctic on 16 Dec. 1999.

The shaded area represents the sea ice extent. The dotted line denotes the mean ice edge averaged for the period from 1972 through 1990.

The data source is the National Ice Center (USA).

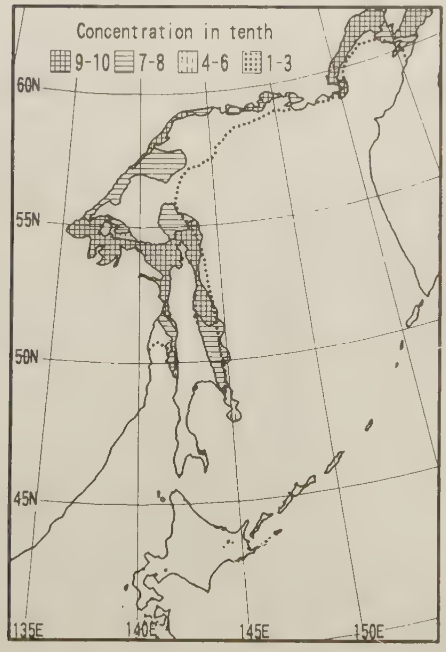


第29-2図　南極域の海氷図（1999年12月16日）

Fig.29-2 Sea ice chart in the Antarctic on 16 Dec. 1999.

The shaded area represents the sea ice extent. The dotted line denotes the mean ice edge averaged for the period from 1973 through 1990.

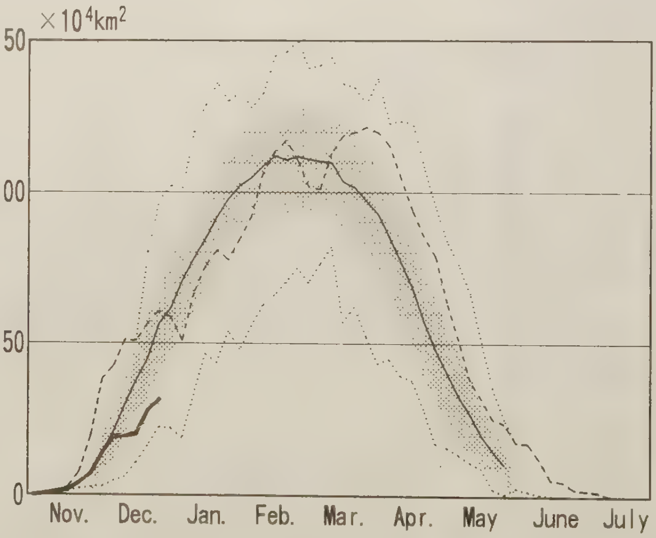
The data source is the National Ice Center (USA).



第29-3図 オホーツク海の海氷図（1999年12月15日）

Fig.29-3 Sea ice chart in the Sea of Okhotsk on 15 Dec. 1999.

The dotted line denotes the mean ice edge averaged for the period from 1971 through 1995.



第29-4図 オホーツク海の海氷域面積

Fig.29-4 Time-series of 5-day sea ice extent in the Sea of Okhotsk.

- ━━━ : current season (1999/2000)
- ――― : mean extent (1971–1995)
- ········ : maximum or minimum extent (1971–1999)
- - - - - : last season (1998/1999)
- (shading) : mean ± 1σ (1971–1995)

海洋気象観測船「春風丸」が東海沖の黒潮蛇行を観測

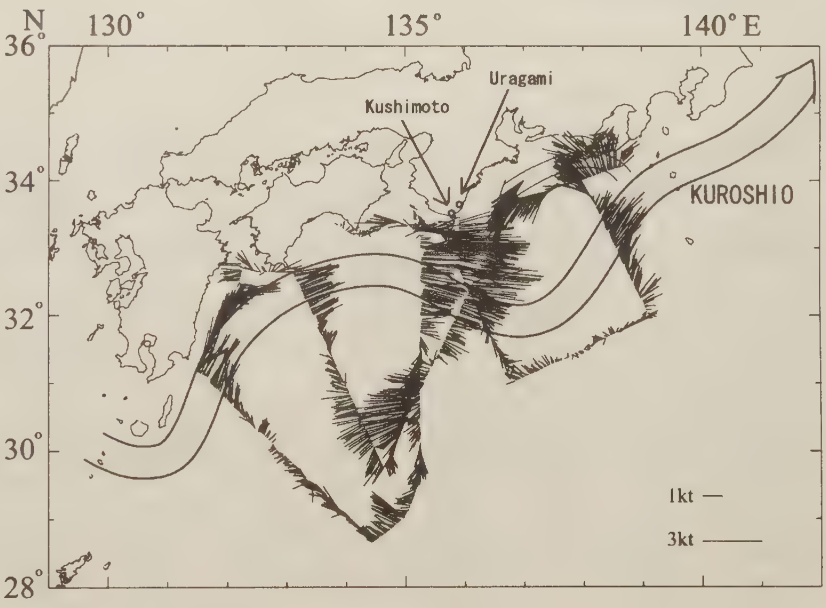
R/V Shumpu Maru observed the Kuroshio meander off Tokai

1999年10～11月の神戸海洋気象台「春風丸」の観測によると、本州南方の黒潮は東海沖で32°N付近まで蛇行していた（第30図A）。これに先立ち黒潮蛇行の指標である串本・浦神の潮位差は9月中旬に急激に5cm以下の小さな値となっていた（第30図B）。また、10月の春風丸の観測によると東海沿岸では蛇行に伴う西向きの強い流れが観測された。この流れに平年より高い水温の影響も加わって、10月上旬から東海沿岸では平常より20～30cm高い異常潮位が発生し、浸水などの被害が起こった。

その後、黒潮の蛇行部は東に移動し、12月には蛇行南端部は31.5°N、140°Eにあり、蛇行の北上部は伊豆諸島の東側に達した。

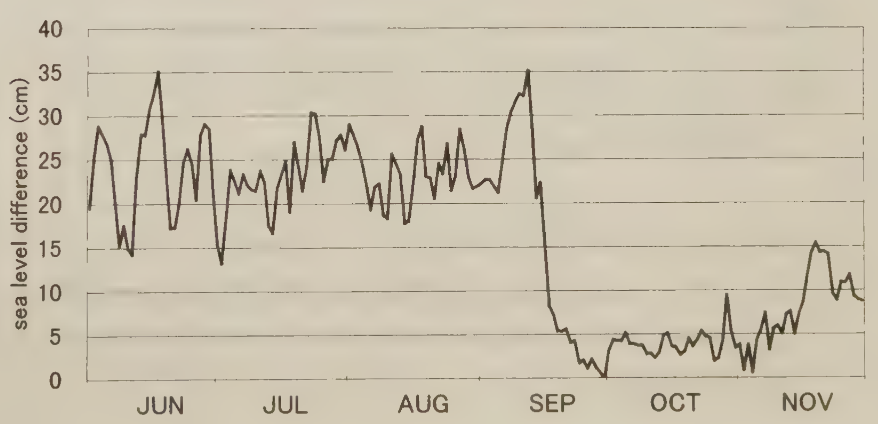
R/V Shumpu Maru of Kobe Marine Observatory, JMA observed that the Kuroshio meandered off Tokai to near 32°N from October to November 1999 (Fig. 30A). The sea level difference between Kushimoto and Uragami tidal stations, which is a good indicator of the Kuroshio path, became suddenly smaller than 5 cm in the second 10-day of September accompanied with the Kuroshio meander off the two stations (Fig.30B). Furthermore, strong westward surface currents along the coast of Tokai were observed by R/V Shumpu Maru in October. This current caused abnormal high anomalies of sea level in the Tokai region from the first 10-day of October. Cooperated with the effect of high water temperature, these anomalies were 20-30 cm higher than usual and the lowlands were flooded.

By December, the southernmost position of the Kuroshio meander has reached 31.5°N, 140°E and it's northward flow path have propagated to east of Izu Islands.



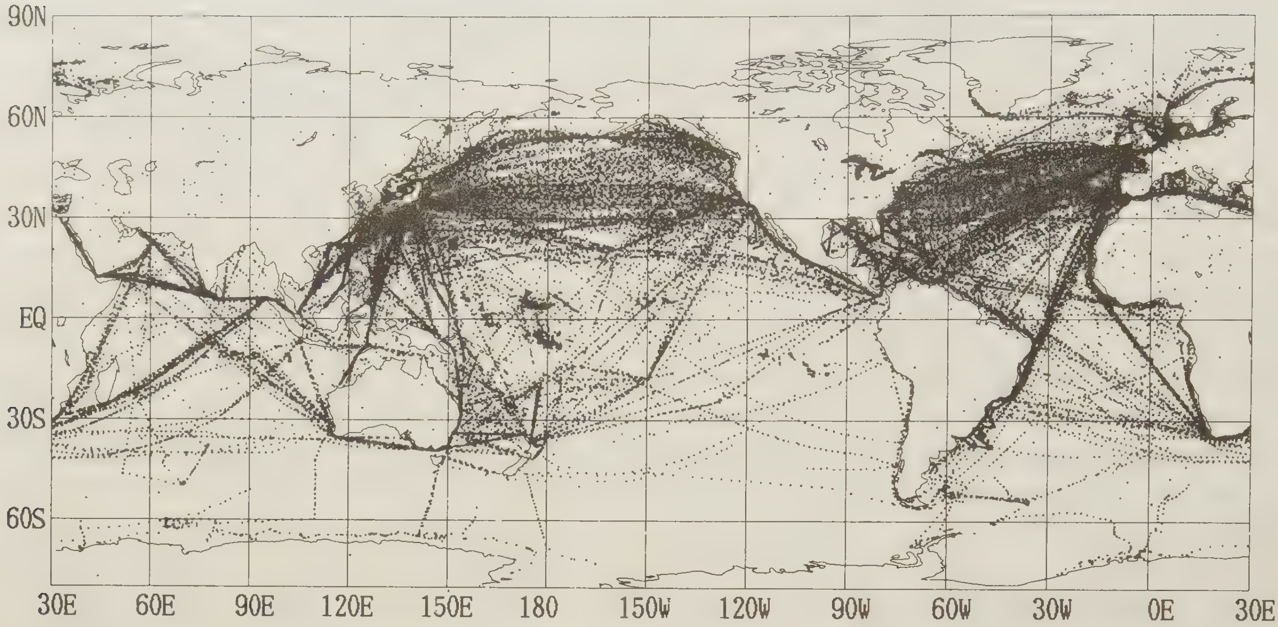
第30図A　神戸海洋気象台春風丸の音響ドップラー海流計による海面の流れ(1999年10～11月)と黒潮流路

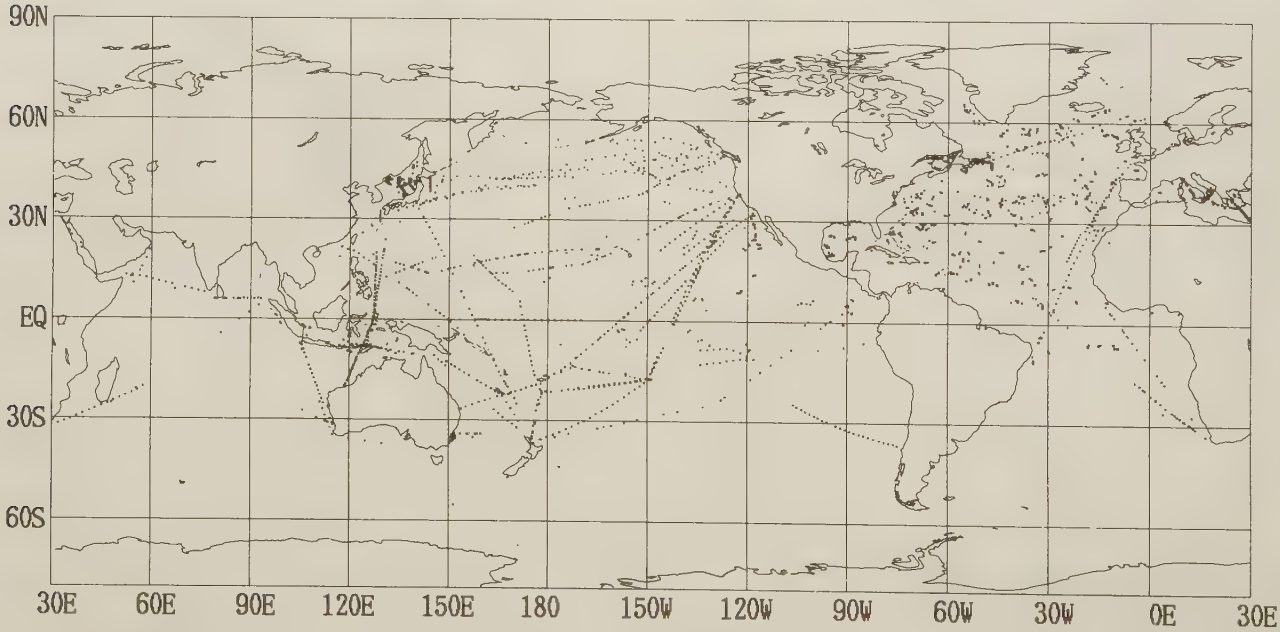
Fig.30A Surface currents measured with Acoustic Doppler Current Meter by R/V Shumpu Maru of Kobe Marine Observatory, JMA from 6 October to 4 November 1999. The large arrow indicates the Kuroshio path.



第30図B　串本・浦神の日平均潮位差の時系列図(1999年6～11月)

Fig.30B Time series of daily mean sea level difference between Kushimoto and Uragami tidal stations from June to November 1999.

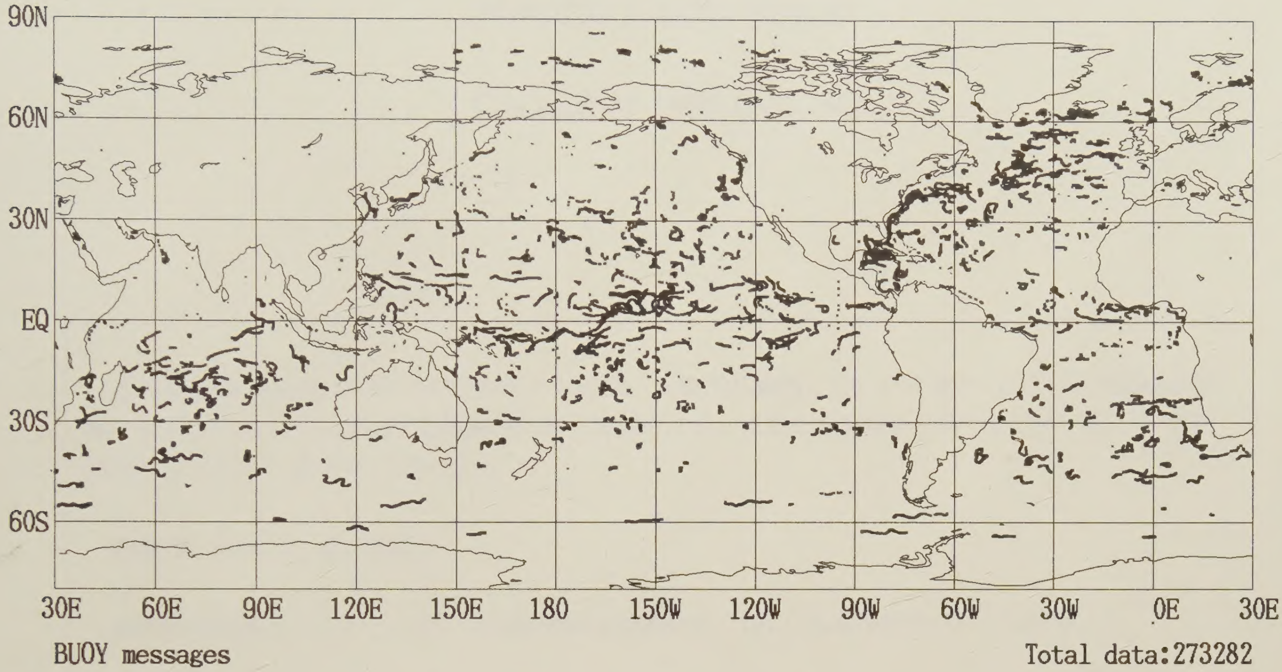


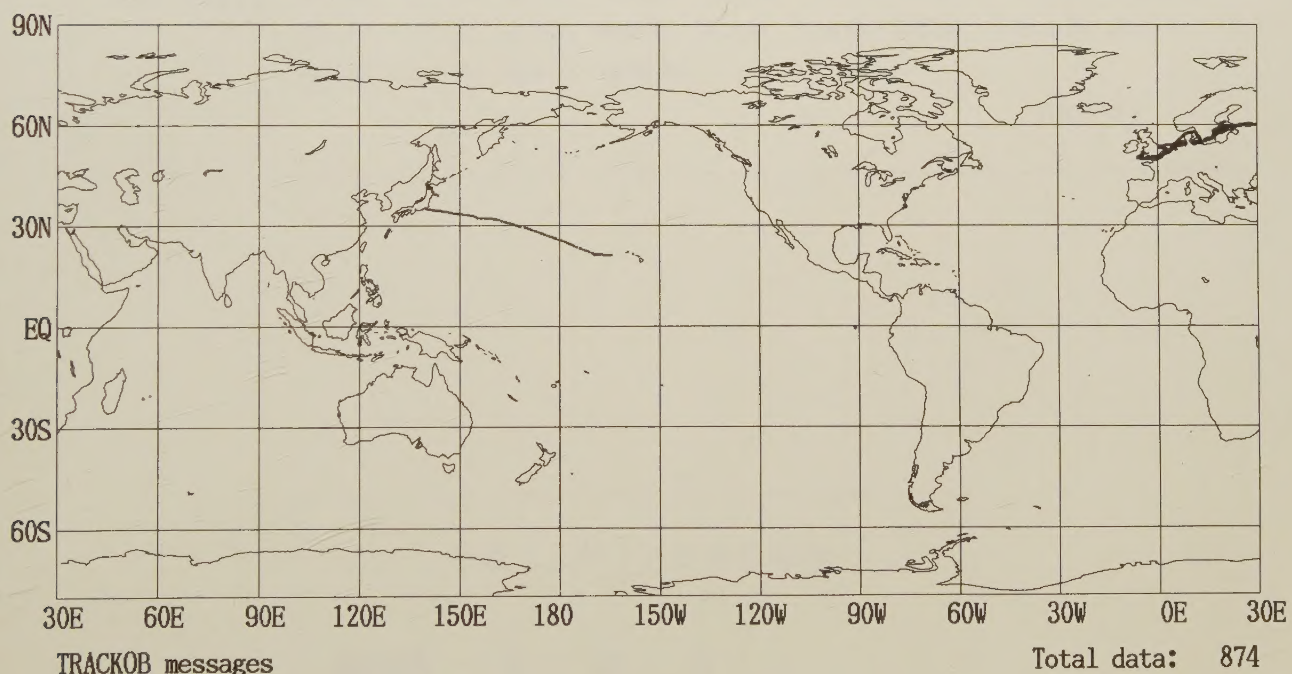


第31-1図　測点分布図(1999年12月)

Fig.31-1 Geographical distribution of SHIP messages (SST data, top) and BATHY/TESAC messages (subsurface temperature data, bottom) for DEC 1999.

Geographical Distribution of Oceanographic Data





第31-2図　測点分布図(1999年12月)

Fig.31-2 Geographical distribution of BUOY messages (buoy drift and SST data, top) and TRACKOB messages (ship drift and SST data, bottom) for DEC 1999.

気 象 庁 海 洋 月 報

Monthly Ocean Report

December 1999 (No. 84)

本月報掲載の 1999 年 12 月のプロダクトには、気象庁が観測したデータ及び GTS（全球気象通信網）を通じて入手した国際気象通報式による通報のほか、下記の機関等から提供いただいたデータを使用しています。御礼申し上げます。

防衛庁、水産庁、海上保安庁

海洋科学技術センター、（財）日本海洋科学振興財団、（社）漁業情報サービスセンター

東京大学、東京水産大学

水産試験場等（北海道、青森県、岩手県、宮城県、秋田県、山形県、茨城県、東京都、新潟県、富山県、石川県、福井県、静岡県、愛知県、三重県、京都府、和歌山県、鳥取県、島根県、山口県、徳島県、宮崎県）

（順不同）

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